THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. XIV NOVEMBER, 1903 No. 11

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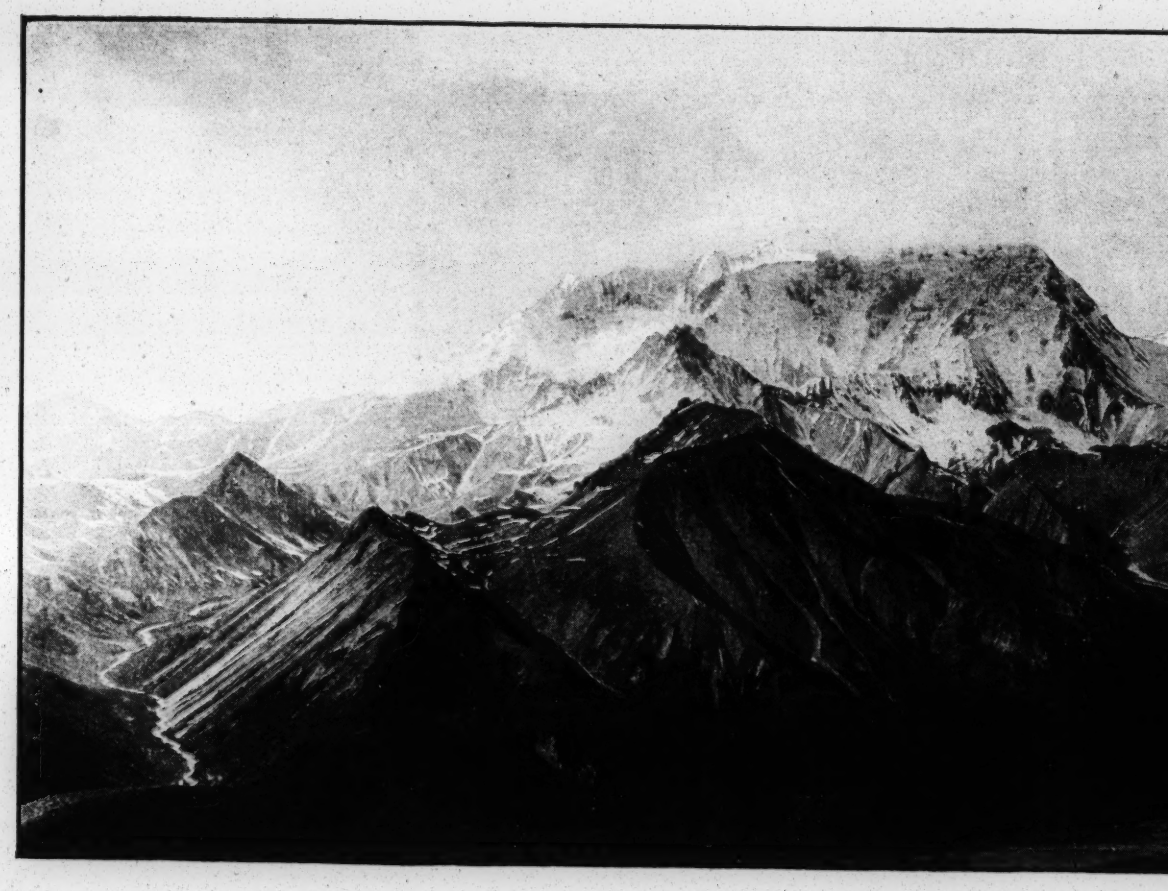

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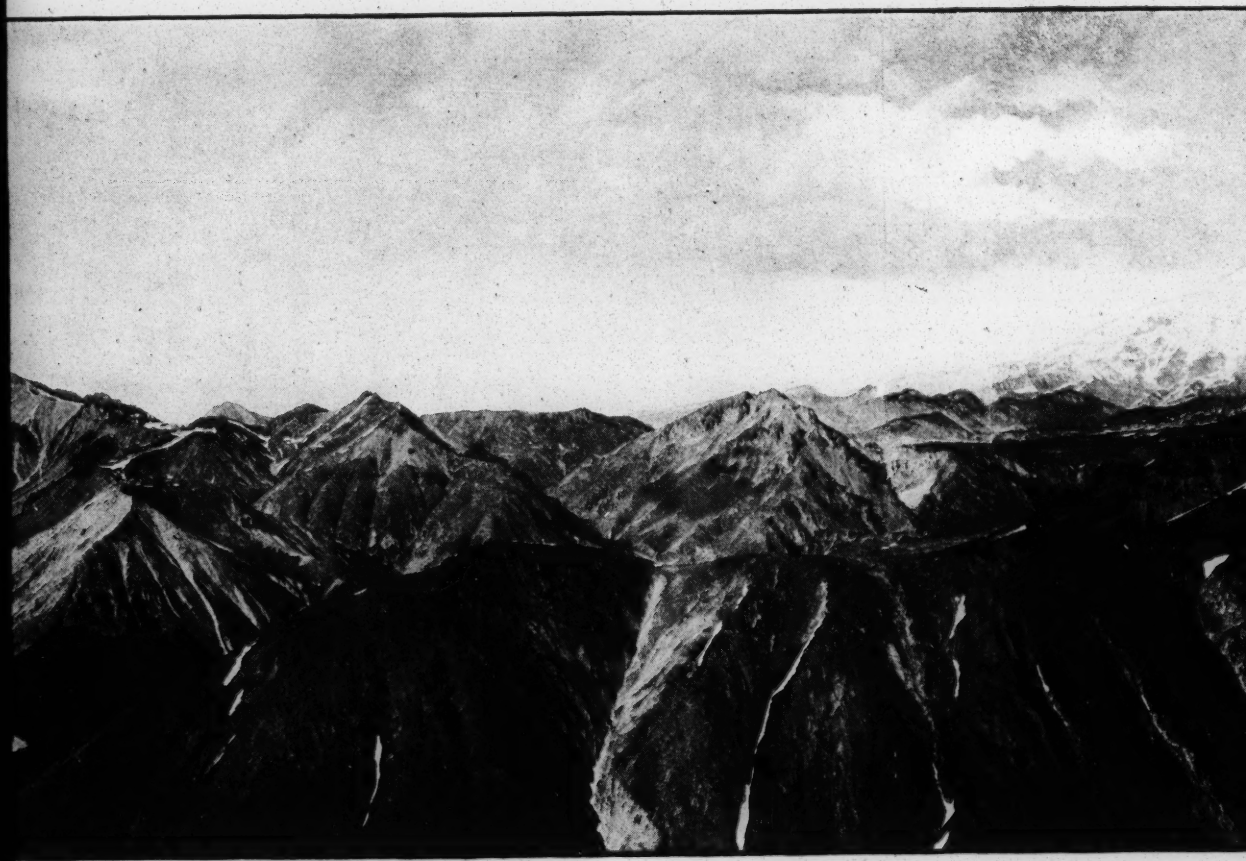

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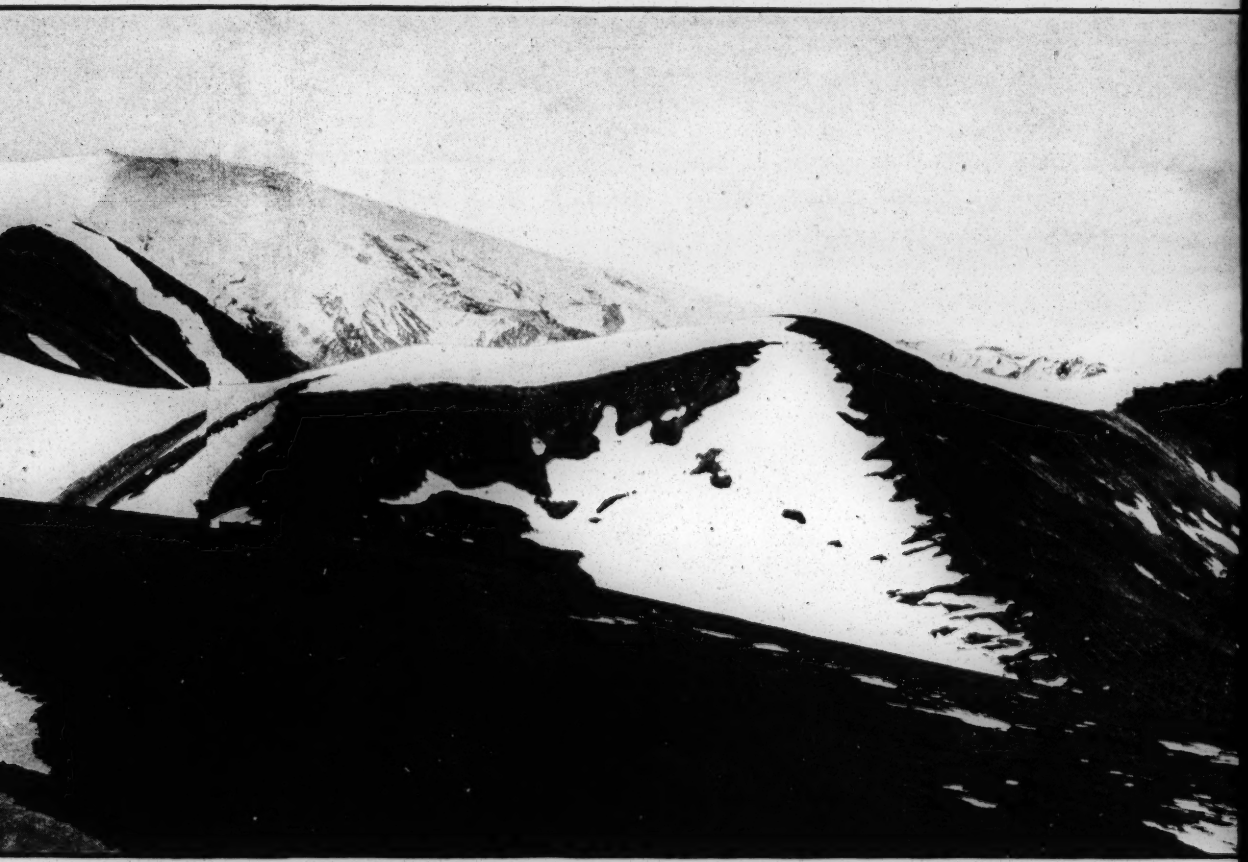

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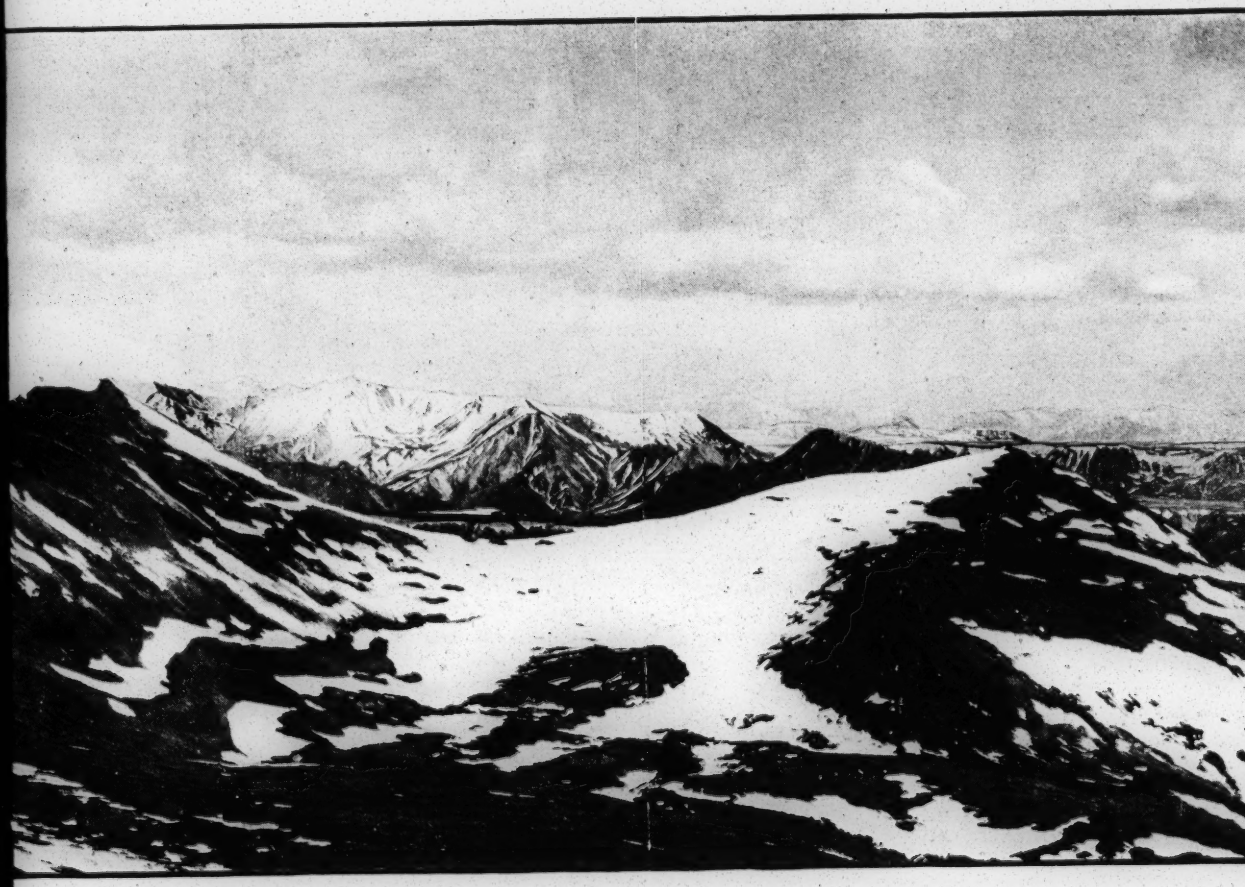

BLACKBURN, 16,140 FEET

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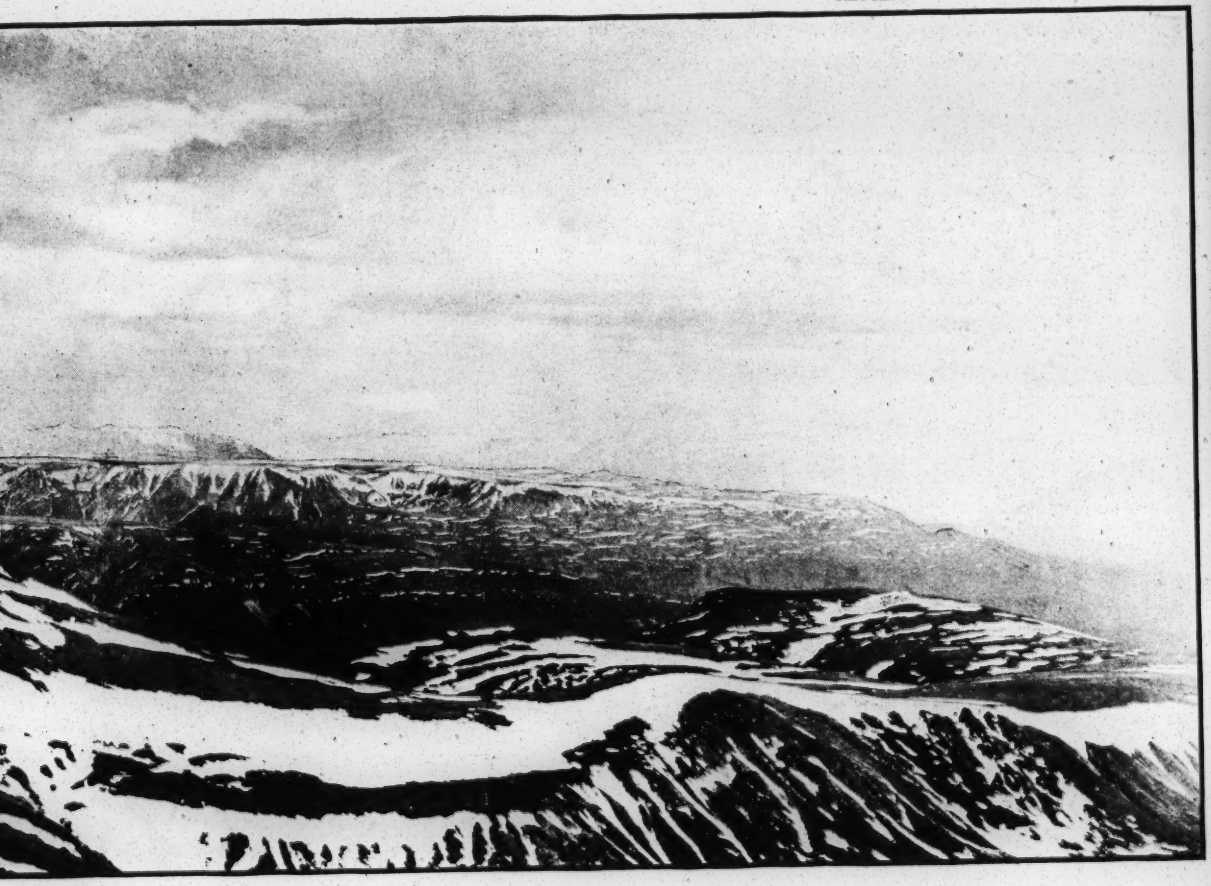


VOL. XIV, No. 11 WASHINGTON NOVEMBER, 1903

THE NATIONAL GEOGRAPHIC MAGAZINE

THE WRANGELL MOUNTAINS, ALASKA*

WALTER C. MENDENHALL

OF THE UNITED STATES GEOLOGICAL SURVEY

MOUNT WRANGELL, the active volcano in the valley of the Copper River, was named in honor of Baron Von Wrangell, governor of the Russian colonies in Alaska from 1831 to 1836. The peak was no doubt first seen by white men during some of the various official attempts by the Russians in the early part of the century to explore Copper River, although they seem to have known of it, under the name Chechitno Volcano, in the eighteenth century, probably from native accounts. The last, the most promising, and the most tragic of the Russian exploring expeditions was that led by the creole Serebrenikoff in 1848. He, with two white companions, was sent by Tebenkof, at that time chief director of the Russian colonies in America, to examine the Copper to its source, then to visit the distant Kwikpak, as the Russians called the Yukon. The work was carried through the Chugatch Mountains which border the coast to some point beyond the mouth of the Copper's western tributary, the Tazlina, where Serebrenikoff and his companions were murdered by natives, whom their behavior had goaded to desperation. Afterward the natives returned the records of the explorers to the Russian authorities.

Probably Russian traders visited the Copper Valley and the Wrangell Mountain region between 1848 and 1867, the date of the transfer of the territory to the United States, for they knew of the easy route from Cook Inlet, where they had strong colonies, by way of the Matanuska Valley to Lake Plevezenie; but there seems to have been no further official attempt to explore in this direction.

After the purchase, our first clear account of the mountain is from the diary of a prospector, John Bremner, who in 1884 ascended the Copper with the interior natives who were returning from the coast to their winter homes. Bremner was in search of the great blocks of native copper which were currently reported to exist in the region. His trip must have seemed hazardous, for he was without white companions, and the Copper River Indians had sustained a

* Published by permission of the Director, U. S. Geological Survey.

bad reputation since the days of the Russian occupation. Bremner expected to winter at Taral, just below the junction of the Copper and its great eastern tributary, the Chittyna, and he carried out his intention in spite of the difficulties which the undertaking involved. The Indians stole his flour, so he snared and ate rabbits. They tested his powers as a shaman by calling him in in cases of sickness. He prescribed thorough baths and applied mustard plasters, curing his patients and making illness a thing to be dreaded at Taral. All of this and more is recorded in a diary whose English and spelling are as original as the tale they tell.

Bremner describes the phenomena which he witnessed of Mount Wrangell in eruption, and gives a brief account of his attempt during the winter to climb the volcano. He estimated it to be 25 or 30 miles from Taral; its actual distance is 40 miles. The natives, always superstitious concerning the mountain, declined to go with him, so he started out alone. He failed of course in midwinter to reach a summit 14,000 feet above the sea, and had his ears and toes badly frozen as a result of the attempt.

In the early spring of 1885, under orders from the War Department, Lieut. Henry T. Allen, U. S. Army, the present efficient head of the native constabulary in the Philippine Islands, undertook an exploration of the Copper and of the Tanana and Koyukuk Rivers. Because of the resolution displayed, the difficulties overcome, and the results achieved, Lieutenant Allen's work stands as a model to this day. At Taral he found Bremner and added him to the party which already contained, in addition to Sergeant Robertson and Private Fisher, Bremner's partner, Peder Johnson. Allen reached Taral over the ice from Alaganik on April 10, and a few days later began a difficult journey up the Chittyna, the great eastern fork of the Copper, and explored it nearly to its source. Later the ascent of the Copper was resumed, and the portage was made from the Indian village of Batzulnetas on the upper Copper to the Tanana Valley by way of Suslota Pass. While within the Copper Valley, Lieutenant Allen went almost around the group of mountains of which Mount Wrangell is the center. He made constant observations on the individual peaks of the group, and later published, in an account of his work, the first map upon which the companion peaks of Wrangell appear. These he named Blackburn, in honor of Senator Blackburn; Sanford, after an ancestor of the explorer; Drum, for the Adjutant General of the Army, and Tillman, in honor of Professor Tillman of the U. S. Military Academy. Mount Wrangell had already been named by the Russians, so that upon Lieutenant Allen's map five great peaks are shown where one had been known before. The actively volcanic character of Mount Wrangell, which had been referred to in Bremner's diary, is repeatedly confirmed by Allen, to whom the smoke column was frequently visible.

After Allen's explorations, the next geographically important work in the area was done by Dr C. Willard Hayes, who in 1891, in company with Frederick Schwatka and Mark Russell, made the long journey on foot from Fort Selkirk on the Yukon to the Copper Valley. Discovering and crossing Scolai Pass, unknown before this time, the hardy explorers built a boat on the upper Nizina from the canvas in which their blankets had been wrapped, and in this frail craft floated down the Nizina and the Chittyna to the Copper. Scolai Pass, which with its approaches was mapped by Doctor Hayes, is properly to be regarded as the eastern limit of the group whose dominant summits had been indicated by Allen.

In 1898, during the first year of the

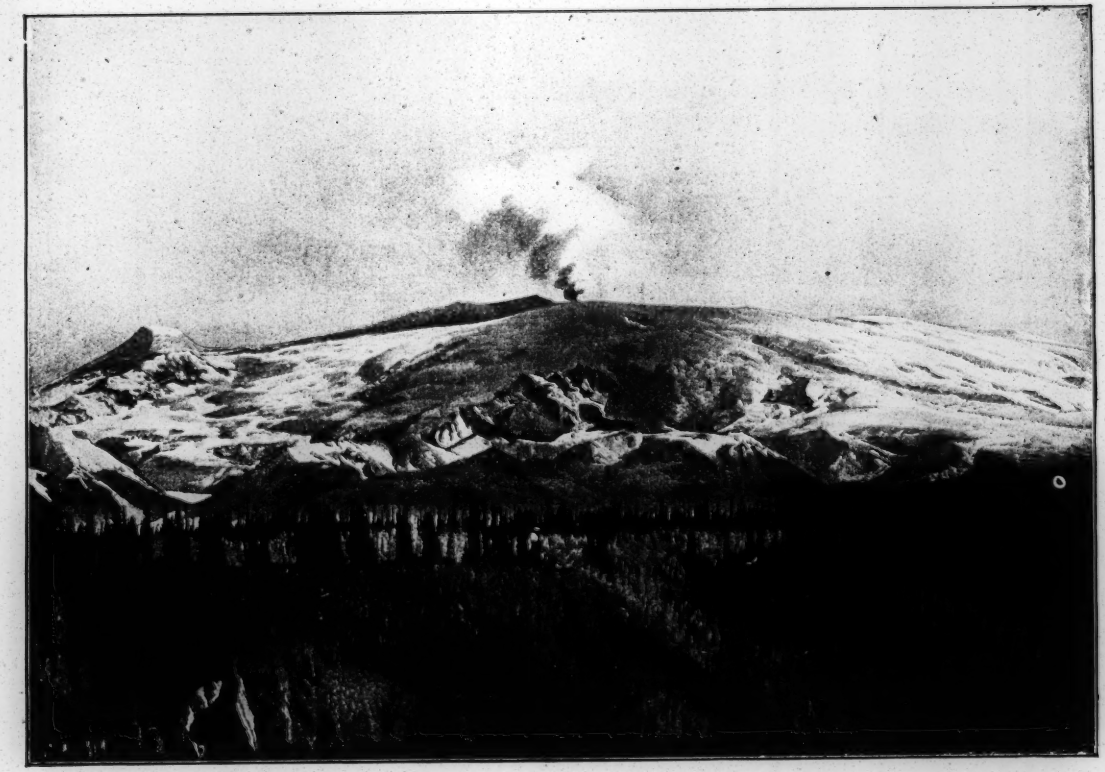


Photo by W. C. Mendenhall

Mount Wrangell

View taken from the government trail above Tonsina bridge, 45 miles from the summit of the mountain

rush to Alaska, some additional mapping in the Copper Valley was done by army officers and by prospectors, and especially by Schrader and Mahlo, attached to Military Expedition No. 1. This work was confined, however, to the district south and west of the mountain group and added little to our knowledge of their geography. In 1899 a journey was made, which in its daring and success equals those of Allen, Hayes, and Schwatka as a geographic feat. The distance covered was not nearly so great, but the time consumed was also much less. Oscar Rohn, topographer and geologist to the military expedition under command of Captain Abercrombie, with a small pack train, penetrated for the first time with animals the rough country lying between the Chittyna River and the south slope of the Wrangell Alps. Reaching the Nizina or north fork of the Chittyna in September, and seeing, as he thought, the possibility of crossing the range to the north of him by way of one of the glaciers tributary to this stream, Mr Rohn sent the pack train back to Valdez and with one companion, Mr McNeer, started across the mountains. The pass at the head of the glacier proved to be 8,000 feet above sea-level, and the distance from the beginning of the journey over the ice on the Nizina side to its end at the source of the Chisana (Tanana) was nearly 50 miles. The route, the character of the ice to be traversed, the distance, and the point to be reached on the other side were unknown. After 15 days on the glacier and many delays from the storms which prevail at this season of the year in these latitudes, the two explorers found themselves at the source of the Chisana, the eastern fork of the Tanana, nearly out of supplies and with a difficult and little-known region separating them from the Copper Valley. On foot, and carrying their light outfit, they crossed Cooper Pass to what they hoped would be the Copper, only to find that it was the Nabesna, the great western fork of the Tanana, and that the Copper was still to the west of them. Ice was forming in all the streams and snow lay thick in the passes, but with the aid of natives they reached the Copper in early October, Copper Center a week later, and crossed Lowe River divide to Valdez through 3 feet of new snow on the 25th. This work, although a reconnaissance, added valuable details to our knowledge of the northern and southern flanks of the Wrangell Mountains.

All of the work which has been outlined, up to the close of the season 1899, was general in its character. Allen had indicated the presence of five great peaks in the Wrangell group where four existed, and his longitude was in error by 30 minutes. Mahlo, in 1898, corrected much of this error in longitude, but since he descended the Klutena to Copper Center, and then went down the Cooper, he could add little to the geography of the mountain group proper, which lay well to the northeast of his route. Rohn, in his work along the southern flank of the range, sketched details previously unknown there, and in his trip from the Nizina to the Tanana studied a high area which is not likely to be investigated soon again. Peters and Brooks, during the same year, contributed to our knowledge of the Chisana and the Nabesna and outlined the northern edge of the range.

In 1900, however, Messrs Gerdine and Witherspoon, of the U. S. Geological Survey, as members of a party in charge of Mr F. C. Schrader, carried a stadia line into the interior from a Coast Survey base on Prince William Sound. From locations given by this line a triangulation network was expanded and extended eastward over practically the entire valley of the Chittyna and its tributaries. For the first time Mount Blackburn was measured accurately, and the topographic features of all this southern

side of the range were delineated in detail and with fidelity.

In 1902 the same workers continued their surveys, Mr Gerdine along the western flanks of the mountains and Mr Witherspoon along the northern, so that we at last have topographic data of a definite nature for nearly all of the group. The area which is not as yet accurately mapped extends east from the head of Nabesna glacier to the head of White River, and includes the glacial drainage of the upper Chisana. Over the remaining portion of the group we have topographic sheets on the scale of 4 miles to the inch, drawn with a contour interval of 200 feet. These give sufficiently complete data for an accurate definition of the geographic relations of the mountain mass.

In carrying on this work the surveyors travel from place to place by pack train, occupying, successively, high points, which are located by intersection on other previously determined positions. From these points—"stations," as they are called—the positions of all prominent features in sight—peaks, streams, lakes, and glaciers—are fixed by horizontal angles, and elevations are determined by vertical angles. With these locations and elevations as a foundation, the streams are drawn and the outlines and slopes of the mountains shown by contours, each feature being sketched while the map-maker is looking at it. The work is precisely similar to that carried on in the rougher parts of the United States, except that the scale is smaller, the spacing of stations is not so carefully done, and less detail is preserved.

CHARACTER OF THE MOUNTAINS

The Wrangell group occupies a rudely elliptical area, with the extensive lowlands of the Copper and the Chittyna valleys on the south and west, but connected toward the east with the somewhat greater heights of the St Elias Alps. A well-marked depression on the north, which extends from the upper Copper across the Nabesna and the Chisana to the White, separates them from the neighboring Nutzotin and Mentasta ranges. Measured along the greater diameter of the ellipse from Scolai Pass northwestward to the outer base of Mount Drum, the extent of the group is about 100 miles, while the other diameter at right angles to this is approximately 70 miles in length. Within this area of 5,500 square miles are at least ten snow-clad peaks 12,000 feet or more in height. Several of these are unnamed, and two of them, Mounts Sanford and Blackburn, are higher than Mont Blanc or any of the peaks within the borders of the United States.

A partial list of the principal peaks and their elevations has appeared in an earlier issue of this Magazine, but a fuller list is appended here:

Mount Sanford	16,200
Mount Blackburn	16,140
Mount Wrangell	14,000
Mount Regal	13,400
Mount Zanetti	12,980
Mount Jarvis	12,300
Mount Drum	12,000
Capital Mountain	9,697
Mount Gordon	9,100
Snider Peak	8,345

In addition to these summits, to which names have been applied, there are two or three unnamed points on the ridge between Wrangell and Blackburn which are 10,000 feet or more in height, while between Blackburn and Regal one peak is 13,400, another 12,925, and a third 12,185 feet high.

These latter are merely the culminating points of a lofty ridge, and lack the dignity and impressiveness of the isolated summits, Sanford, Blackburn, Wrangell, and Drum, which are by far the most conspicuous mountains in the group. The fact that great height is not essential to grandeur is well illustrated by Mount Drum, which is sur-

passed by none in beauty and impressiveness, although but 12,000 feet high. Its effectiveness is due to its situation well out in the Copper River plain and to its isolation.

The Wrangell Mountains lie between the meridians of 142° and 145° west longitude and the parallels of 61° 20′ and 62° 30′ north latitude. The 144th meridian and the 62d parallel intersect just east of the crater of the central peak—Mount Wrangell.

The group is as distinct in form from the neighboring ranges north and south of it as it is in origin. The Chugatch Mountains, which lie between the Wrangell Mountains and the coast, represent an uplifted and eroded plain, and this origin is now recorded in the level skyline presented by the tops of the individual peaks and ridges which make up the range as a whole.

The Alaskan Mountains to the northwest owe their relief to profound fracturing of the earth's crust, the rocks to the north of the break being lifted high above those to the south. Erosion, acting on this broken edge, has carved the serrate crest as we now see it, leaving the areas of harder rock in high relief.

The Wrangell Mountains, on the other hand, are for the most part masses of lava and volcanic mud, which have been piled up on an earlier surface, of considerable diversity, burying the old land forms and substituting for them the present splendid group.

The heights rise from the valley of the Copper River, which along the west base of the mountains stands at from 500 to 1,500 feet above sea-level. This valley is a gently sloping, moss-covered, lake-dotted plain, in somber green, accentuating by its level character and its dull coloring the great heights and the dazzling white of the adjacent summits.

Indian travelers say that Mount Everest is dwarfed by the elevation of the land mass from which it rises and by the surrounding close-set peaks, which are but little lower than Everest itself. At Yakutat, one is in doubt at first as to which of the great summits in sight is St Elias. Logan's superior height was recognized only after the angles to its top were solved. McKinley alone stands out in solitary grandeur. But each of the four striking peaks of the Wrangell group has its own individuality and seems to accentuate, not to dwarf, its neighbors. Each, as it were, serves as a scale which helps the eye to comprehend the magnitude of all.

The shapes of the peaks are the combined products of vulcanism and erosion. Either predominating gives a distinct type. Intermediate forms are due to the partial ascendency of one or the other force. Mount Wrangell owes its outlines almost wholly to volcanic action. Erosion has modified this original form but little. Mount Drum's contour, on the contrary, is that due entirely to denuding agencies. The original built-up form is gone. Mount Sanford is a volcanic dome, one-half of which has been mined away by a sapping glacier. Mount Blackburn has been etched on all sides until only its summit has the gentle original slope; all below this is the precipitous wall due to undercutting ice.

Wrangell is a great flat cone nearly three miles high and eight times as broad. Its gently arched surface is a glistening snow-field, broken here and there by a smoking rock or touched at the summit by a smudge of ash from the crater which sends up intermittently rolling columns of smoke and vapor. From its eastern slope flows Nabesna glacier, a frozen river fifty miles in length. On its western face, in a shallow valley, a dozen jets of steam may be seen on a still morning issuing from as many vents, and the glaciers from this basin are black with the breath of the mountain.

It is not recorded that the summit

Mount Drum

Photo by W. C. Mendenhall

has ever been reached. John Bremner, who was a prospector and a man of imagination, reports that he got to within a mile of the top. It is probably well that he did not attempt the last mile. A report is current in the Copper Valley that some years ago two miners attempted to reach the crest on snowshoes, but, after traveling the greater part of the day and finding the summit still distant, wisely decided to return.

If you interview the Copper River native about Mount Wrangell you will find him reticent; but if you finally win his confidence and gratitude by a square meal and a pipeful of tobacco without demanding some service in return, he may reward you by telling you in compact but fragmental English the native legend of the tragedy of the mountain. "Long time ago two Siwash go look see; mountain him smoke. One Siwash come back. Hiyu (much) smoke. No good." As he tells you he squats on his haunches in the door of your tent, fingers all of your personal belongings, and reeks with the accumulated odors of generations of unwashed fish-eating ancestors.

You are tempted to wish that more Siwashes had gone to the "Mountain that Smokes." It is an unworthy wish. The native is but a brown child of the wilderness, curious, uncontrolled, timid, uncomprehending. The white invader is feared for his numbers, his energy, and his ability, but he is past understanding. His restless, all-sacrificing search for gold or copper or other useless stuff, his abundance of all the greatly desired things—clothing, food, guns, tobacco—which come off the great water in unlimited quantities, but are dispensed to the needy Siwash most grudgingly; his curious doctrines about right and wrong, and property and work, doctrines which he seems to expect the native to observe, but which he himself so often ignores—altogether the white man is quite beyond native comprehension.

FEASIBLE ROUTES FOR THE ASCENT OF MT WRANGELL AND THE HIGHER PEAKS

But, in spite of the native's fear of it, the "Mountain that Smokes" should be climbed, and climbed soon. It will not be a difficult feat, and the reward will be unique. It is not likely that the summit of Mount McKinley will be reached at an early date, and so Mount Wrangell should be the first of the great interior peaks of Alaska to be scaled. The attempt is earnestly recommended to any one of the numerous active mountaineering clubs of the United States. The line of perpetual snow is at about 6,500 feet, and the summit rises 7,500 feet above this. At this summit is a crater which sends out columns of smoke 3 miles high. The relation of the crater to the ice cap will be most interesting, and the mere feat of first reaching the summit of the only known active volcano in the interior of the continent north of the Mexican line may well appeal to any man.

There are at least four feasible routes of approach. One is from a plateau at the head of Dadina River, between Mount Drum and Mount Wrangell, and the way leads southeastward past the base of Mount Zanetti, the spur to the summit. A temporary camp can be placed on the mesa at the edge of the ice cap from the valley of the Dadina or the Sanford. It may be possible to take horses up on this mesa from the Dadina Valley, but the matter has not been put to a practical test. From such a camp the march to the summit would be long, 10 or 11 miles, but would lead past the foot of Mount Zanetti over a snowfield which is very smooth.

Two routes, either of which is probably feasible, lead from the head of the valley of the Chetaslina River. The middle fork of this stream rises from a double glacier, which owes its compound character to a nunatak about 3 miles long, rising above the ice level at about an equal distance back from the foot of

the glacier. The lobe of the glacier, which lies to the west of this nunatak, is smooth and easily crossed. Pack animals could be taken over it nearly, if not quite, to the nunatak. From a camp near the upper end of the nunatak, to which fuel would have to be taken, the ice cap is easily accessible at an elevation of about 6,500 feet and only 6 miles, air-line distance, from the summit. This route, however, lies across the crevassed basin forming the western face of the peak, and although most interesting, since it passes the "Field of the Jets," a region of steaming rock points, is likely to offer some difficulties and dangers.

The other suggested route from the head of the Chetaslina follows the eastern edge of the glacier and by a steep rock climb gains the ice, at 7,000 feet or over, not more than 5 miles in an air line from the summit. By traveling almost due east over the ice for about 4 miles, this route would avoid the Field of the Jets and would converge with that next to be described, near a long, low ridge of steaming rocks which lies a couple of miles south of the summit at an elevation of 11,000 feet.

What appeared after an inspection of the peak from all sides in 1902 to be the surest and safest route, although not the shortest, is from the northern end of the broad mesa which separates the Cheshnina from the Chetaslina drainage. Pack horses can be taken up on this mesa from the east fork of the Chetaslina and a base camp pitched at about 6,000 feet. From the edge of the ice cap, a mile above this camp, to the summit, is 7 miles, and the route lies over the long, low, smooth spur of which the mesa is the continuation. The intervening snow-field appears to be perfectly smooth and safe and the approach by it is the one recommended. Last summer (1902) members of the Survey party climbed this thin spur through rain and fog to between 7,500 and 8,000 feet and experienced no difficulty except that caused by the soft snow. In the course of geologic work the ice cap was reached and traversed for perhaps a mile from the nunatak at the head of the Chetaslina also, so that the lower portions of both these lines of advance have been tested.

In an attempt of any of the high peaks of interior Alaska, it is essential to be on the ground ready to make the climb early in the season. After July 1 the weather becomes warm and the snow-clad higher summits become storm centers, which condense the vapor from the heated lowlands, and as a consequence are hidden for much the greater part of the time in clouds. It is needless to say that one cannot climb unknown peaks successfully through a fog which conceals all their features. In an average season, a perfectly clear day after July 1 cannot be reckoned upon until late in the fall, when the nights have lengthened and the summits are covered with new snow. The proper time to climb is about June 20. In addition to the good weather, which is much more probable then than later, the days are the longest of the year, and although the sun is below the horizon for two or more hours, there is no real darkness. With clear weather the air chills quickly at the greater altitudes as the sun sinks, and a crust forms over the snow, so that rapid progress can be made. This is particularly important in climbing Wrangell, because the slopes of the peak are so gentle that just above the line of melting there is a wide zone of snow, which is soft and greatly impedes climbing unless a crust is formed over it.

Ordinary precautions will have to be taken, of course, in crossing these unexplored snow-fields, even where no crevasses are visible. During 1902 two employés of the Survey were crossing a glacier on the north flank of Mount Wrangell to reach a high point which it was intended to occupy for topographic work. The snow seemed per-

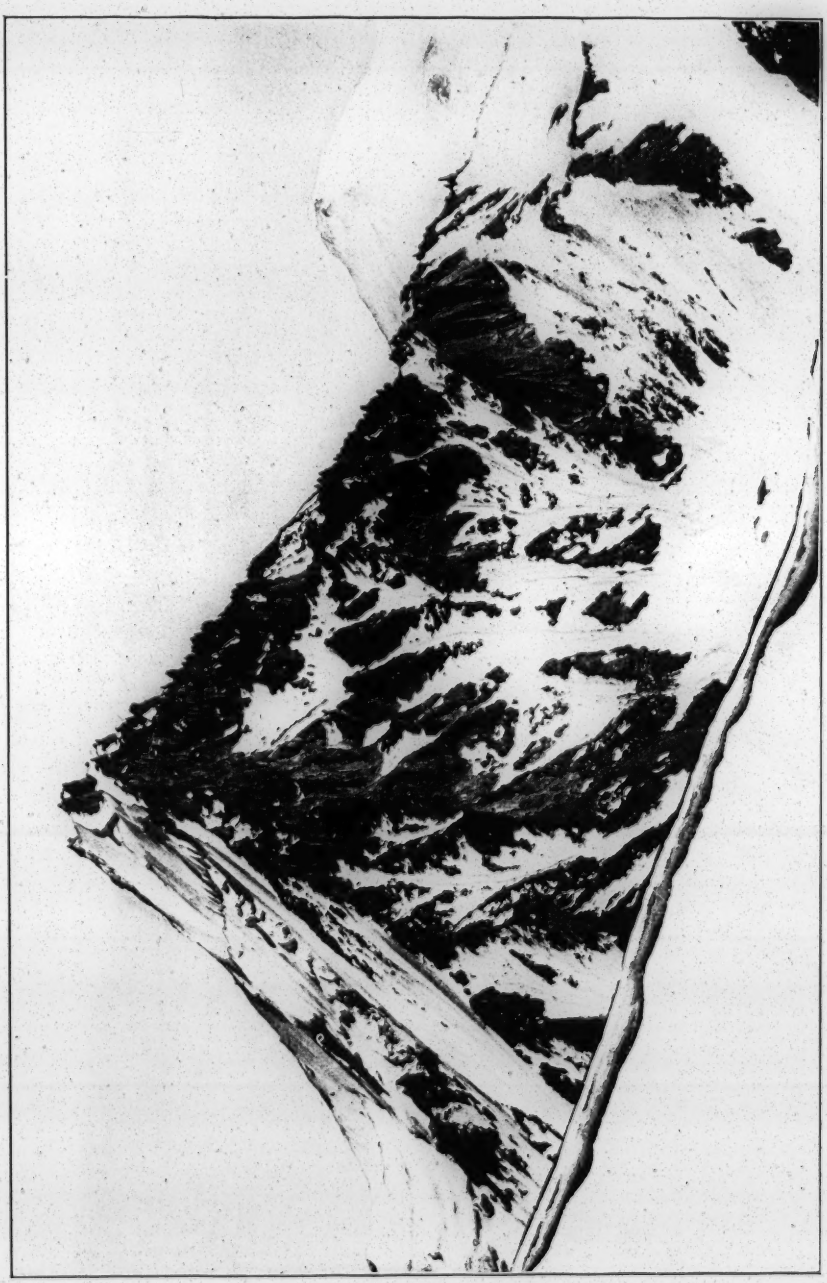


Photo by W. C. Mendenhall

Snider's Peak, as Seen from the West

fectly safe, and the rope which was always carried on such trips was not in use. Suddenly the crust gave way beneath the feet of the man in advance and he sank, but throwing out his arms was sustained by them until dragged out of danger by his companion. Fortunately for him, the concealed crevasse was narrow at the top. The rope was used for the rest of that day.

After Mount Wrangell, the peak which will no doubt prove most interesting from the point of view of the mountain climber is Mount Sanford, the highest one in the group, 16,200 feet above sea-level. This magnificent summit, when viewed from the south between Mounts Drum and Wrangell, presents an outline so totally different from that exhibited by its northern slopes that Allen in 1885, from the mouth of the Chetaslina, named it Mount Tillman, and then from the upper Copper, failing to recognize it, rechristened it Mount Sanford. His supposition that there were five peaks where there are in reality but four, together with the changing aspect of the mountains as one encircles them in following Copper River, led to further confusion. Therefore, in his sketch from 6 miles above the mouth of the Gakona, Mount Drum is called Mount Tillman and Mount Sanford is called Mount Drum. The fact that Allen's Mount Tillman is a myth has been a matter of common knowledge for some years. Mahlo's map of 1898 shows three peaks where Allen had four, and Mr R. S. Dunn, who is now en route to Mount McKinley, has called attention to the error in a recent magazine article.

The southern face of Mount Sanford is a 12,000 foot slope of 60 or 70 degrees—practically a cliff, too steep even for much glacial ice to accumulate. This precipice faces the southwest, and in early summer must be scored by splendid and constantly recurring avalanches. The ice accumulations at the foot of the declivity form Sanford glacier, the source of Sanford river. In remarkable contrast to this precipitous southwest slope, the cirque of Sanford glacier, is the northern face of the mountain. Viewed from any point on the upper Copper River or the foothills beyond it, Mount Sanford appears a smooth, rounded dome of snow, so even, except as glacial erosion has eaten into it around the base, that it appears to be possible to travel over it in almost any direction. Really, however, there are probably few feasible approaches, because the smooth upper reaches of the mountain break off just above the base into cliffs.

A glacier, which is one of the sources of Boulder Creek, appears from below to form an easy way through these encircling cliffs to the even snow-fields above. When these are gained, reaching the summit will depend upon weather and preparedness. It is not possible to make the climb from below snowline in one day, and a well organized party, equipped to stay on the mountain a week with an upper camp at 10,000 feet, will stand the best chance of success.

The writer has not been nearer to Mount Blackburn than the head of Kotsini River, a dozen miles from the peak, and he has not seen it except from the west. Viewed from this direction, its aspect is most forbidding. Near the top the slopes are gentle enough, but up to 12,000 or 13,000 feet its western face is a series of crags and cliffs, scarred by ice falls or covered by steep, deeply crevassed glaciers. Its southern side is reported but little better, so that the most hopeful direction from which to approach it seems to be the north or northeast, from one of the tributaries of the Kennicott or of the Nabesna glacier. Both of these are long glaciers which have not been traversed, or at least we have no record of their exploration, so that in addition to the possibility of finding the mountain inaccessible after reaching its northern or eastern base,

there is the further possibility of difficulty in getting to this position.

Mount Drum is lower than either Mount Sanford or Mount Blackburn by more than 4,000 feet. Its base is more accessible than that of any of the other peaks, as it stands out in the Copper River Valley well to the west of its companions. The air-line distance from Copper Center to the summit is less than 25 miles, and the lowest point in the divide connecting it with the Mount Sanford-Wrangell pile is about 5,000 feet; hence one may travel entirely around the mountain by way of the Dadina and Sanford River valleys without having to make any difficult climbs.

But this little 12,000-foot peak appears to be one of the hardest of the group to scale. It is really but the skeleton of a mountain, having been so eaten away by the Nadina drainage that its summit is only a sharp crescent-shaped ridge, surrounding the amphitheater in which Nadina glacier heads. The prospectors of the region speak of it appropriately as the "shell." Other drainage than that of the Nadina has been active, so that all of its faces are steep, and the ice masses which hang on them are greatly crevassed. It is these which present the difficulties. If Drum were free from glaciers it would be merely interesting as a rock climb. As it is, the only route to the summit which appears to be at all practicable is that by the ridge between the Nadina and Klawasina glaciers. Pack animals may be taken 5 or 6 miles above the foot of Nadina glacier, and camp established on a little flat just west of the glacier, within an air-line distance of less than 5 miles from the summit. By climbing westward, up the valley of a little brook, the ridge in question may be reached at between 6,000 and 7,000 feet, and, so far as may be judged from below, its ascent will not prove difficult up to 10,000 feet. Beyond that it is very narrow, the ice overhangs, is crevassed, and probably unsafe, but careful mountaineers may be able to make their way over it to the summit.

Snider's Peak—Little Drum, it is sometimes called—lies just south of the main peak. It is 8,300 feet high, and although sheathed in ice on its north slope, is free from it on the south and very precipitous.

IMPORTANT GLACIERS OF THE GROUP

Several of the important glaciers of the mountain group have already been mentioned incidentally. The whole central mountain mass above 7,000 feet is a nevé field above which project occasional points, too sharp to permit the accumulation of snow. From this central snow-field Alpine glaciers drain in all directions down canyon-like valleys which the glaciers themselves have moulded. As the divide between the northward and the southward flowing streams lies nearer the southern line of the group, and so near the southern line of the high area in which snow accumulates, it follows that the greatest glaciers flow to the north. The largest of these are the Nabesna and Chisana, ice streams 45 and 30 miles long respectively and the sources of the two great branches of the Tanana River.

Kennicott glacier on the south side of the range, draining the slopes of Mounts Blackburn and Regal, is probably the third of the ice streams in magnitude. Then follow a host of smaller glaciers—Nizina, Kuskulana, Copper, Nadina, Jacksina—all sources of streams of the same name and none of them less than 10 miles in length. The glaciers of the Alps are few in number and insignificant in size, by comparison.

From each of these glaciers flows a turbulent river. Usually, as it issues from beneath the ice foot, the stream spreads out over a wide flood plain, built up of coarse material, upon which it constantly shifts its numerous channels. After a course which varies from a few to many miles over such a flood

plain, the channels unite and enter a canyon cut in the flood plain material or in the rock beneath it, and in this canyon the tributary continues to or nearly to its junction with the master stream. Sometimes just above this junction a second flood plain is developed.

These rivers, like all others with glacial sources, are at their highest stages during midsummer, when melting of the snow and ice is at the maximum, and are lowest in the late winter, when this is at a minimum. In the summer they are muddy, overloaded with ground-up rock fragments; in the winter they are clear, and the trout, driven from them in summer, return to them.

The greater part of the drainage of the Wrangell Mountains is gathered into the Copper River, whose basin of nearly 25,000 square miles includes a large proportion of mountainous territory, in which glaciation is at present active. Among the large streams of the continent, it is perhaps the most nearly purely glacial in its sources of supply, and a comparison of its grade, which is dependent, in part at least, upon this fact, with those of other streams becomes interesting.

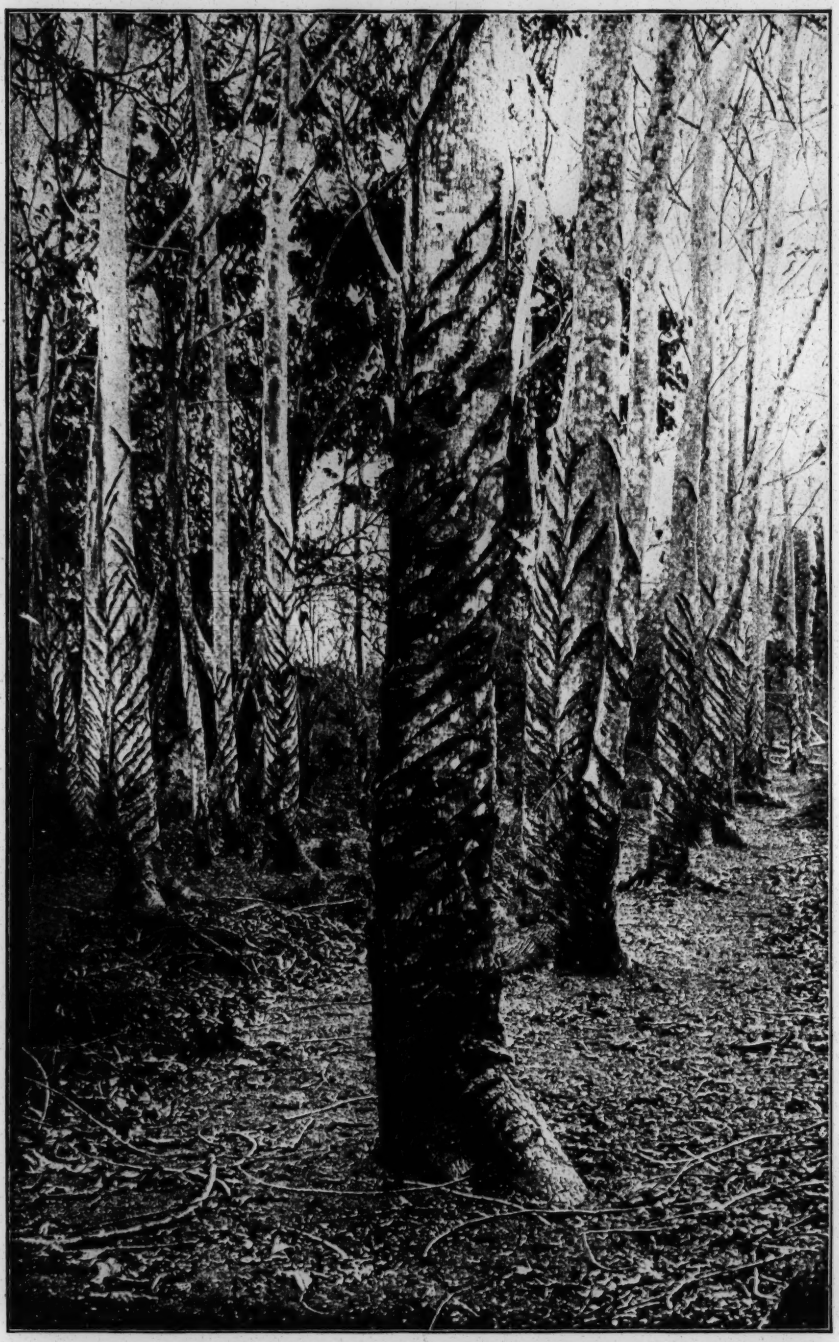
The total fall of Copper River, from its sources in Copper Glacier to the sea, a distance of about 300 miles, is 3,600 feet—an average of 12 feet per mile. The lower half of the river, from Copper Center to the mouth, has an average fall of nearly 7 feet per mile, while the upper half, between Copper Glacier and Copper Center, falls about 17 feet in each mile.

Compare with this the fall of the Yukon, which between White Horse and the sea is approximately 1.2 feet per mile, and below Fort Yukon about .5 feet per mile, or that of the Ohio, which between Pittsburg and Cairo is .435 feet per mile. The relatively torrential character of the Copper as a type of glacier-fed stream thus becomes strikingly evident.

Copper River drains the southern, the western, and a part of the northern slope of the mountains. The central part of the northern face drains into the Tanana by its two great tributaries, the Nabesna and the Chisana, while some of the glacial drainage from the extreme northeastern limit of the mountains passes down the valley of the White to the Yukon.

The district embraced by the group offers many attractive problems to those interested in physical geography or geology and the allied sciences. The problems of land forms as determined by vulcanism and as modified by glacial erosion, questions of ice accumulation and shrinkage, of glacial deposition, of the aggradation of glacier-fed streams, unique problems of vulcanism and glaciation, such as subglacial lava streams, and modifications of glaciers by the heat attending volcanic activity are a few of the questions which immediately occur for investigation here.

The opening of the military trail from the port of Valdez, on Prince William Sound, and the establishment, by prospectors and others, of various secondary trails to points within the foothills of the Wrangell Mountains have made the whole region comparatively accessible. It is quite probable that the next few years will see a railroad built to the copper properties in the Chittina Valley, which will remove the present necessity of making a trip of 150 miles by pack train and will place the traveler in the interior valley of the Copper at any season of the year. When that time comes, the Wrangell Mountains should prove an attractive field for students and for those tourists who desire to get a little beyond the usual summer frontier. The maps which are now drawn and will soon be publicly available will serve as guides until the time shall come when larger-scale work is required, and the preliminary geographic studies which have been carried out will serve to indicate the tenor of the closer studies of the future.



From O. F. Cook, Department of Agriculture

Picture No. 1.—A Plantation of Castilla Rubber Trees

The trees are about 14 years old. They can be tapped when they are eight years old, and after that every few months

RUBBER PLANTATIONS IN MEXICO AND CENTRAL AMERICA

NEXT to coffee and sugar, crude rubber is the largest of the tropical imports of the United States. It is the only one of these three for which we are entirely dependent on foreign countries. The value of the crude rubber that we import every year, 55,000,000 pounds, reaches about $30,000,000, but none of it comes from Porto Rico or the Philippines. Over one-half of the total is imported direct from Brazil, while considerable quantities come from the United Kingdom, presumably the products of her colonies, and from Belgium, chiefly the product of the Congo Free State.

It occurred to the Department of Agriculture, while pondering what new industries might be found for Porto Rico and the Philippines to improve conditions on the islands, that rubber trees might be grown profitably on them. An agent of the Department, Mr O. F. Cook, was therefore sent to Central America and Mexico, where millions of dollars are invested in rubber plantations, to study rubber culture and to report on the advisability of starting similar plantations in our new island possessions. Mr Cook spent several months at the different rubber plantations, and his preliminary report has been published by the Department.

It is yet too soon to state definitely whether rubber trees can be successfully grown in Porto Rico, but the prospects seem favorable for growing the Castilla rubber tree, as the southwestern part of the island is dry and hot. It should be noted that crude rubber may come from three different kinds of rubber trees, each requiring different climate and soil. There is the Para rubber tree (*Hevea*), which thrives in the wet valley of the Amazon, but which will not grow in a dry climate; the Assam rubber (*Ficus elastica*) of Java, also needing a humid atmosphere; and the Castilla rubber tree of Central America and Mexico, which prospers best where it is dry and hot and will not grow in swamps or wet soil. Mr Cook recommends that experiments be begun by planting a number of Castilla rubber trees in Porto Rico and the Philippines, but he warns the American public against investing large sums in starting rubber plantations until it has been proved that the rubber tree will grow successfully on these islands.

The accompanying illustrations, for the use of which the NATIONAL GEOGRAPHIC MAGAZINE is indebted to Mr Cook, give interesting information about the rubber tree and the native Mexican method of tapping it for its milk.*

It would seem to be a very simple matter to improve on the rude gashes made by the machete of the rubber gatherer, but this has not proved to be easy. The rubber milk is not the sap of the tree and can not be drawn out by boring holes in the trunk, as is done with the sugar maple. The milk is not in the tissues of the tree, but is contained in delicate tubes running lengthwise in the inner layers of the bark, and to secure milk in any quantity it is necessary to open many of these tubes by wounding the bark. The rubber is formed in floating globules inside the tubes and can not pass through their walls, so that even a suction apparatus would not bring it out unless the tubes were cut.

The method by which the natives of Soconusco, Mexico, have been accustomed to extract the milk is shown in

* Consult "The Culture of the Central American Rubber Tree." By O. F. Cook. U. S. Department of Agriculture: Bureau of Plant Industry—Bulletin 49.

From O. F. Cook, Department of Agriculture

Picture No. 2.—A Native Tapping a Castilla Rubber Tree

At Zacualpa, Chiapas, Mexico. The tree shown in this picture is a small one. Many of them exceed five feet in diameter, with trunks going straight up for 30 feet

Fig. 1

Fig. 2

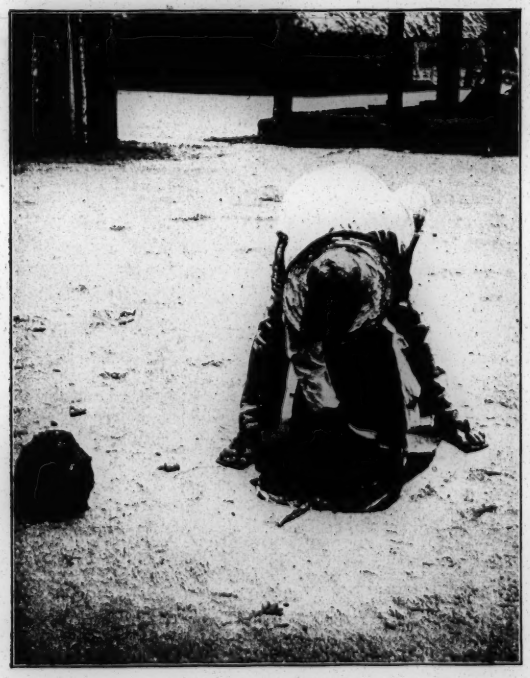


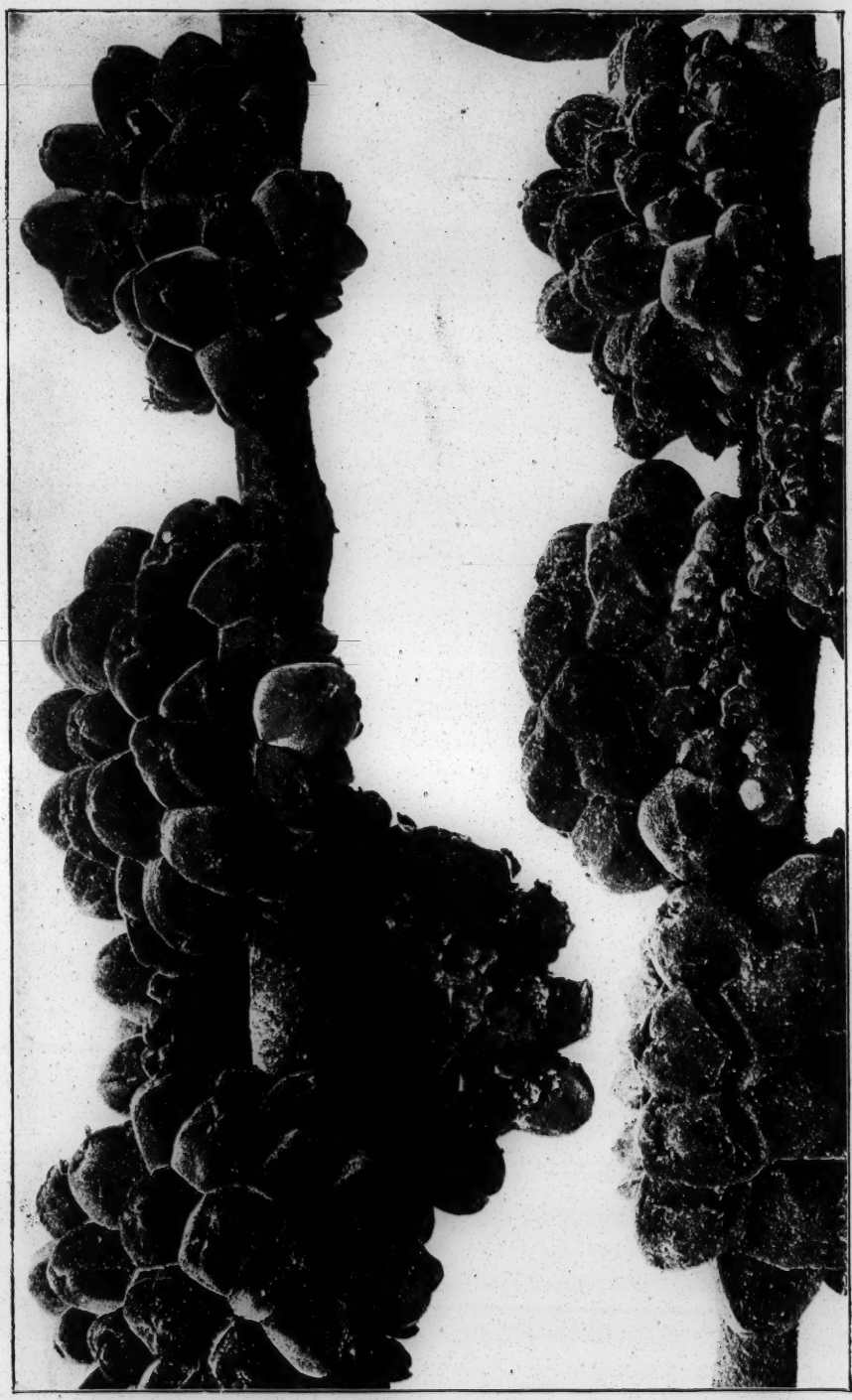
Fig. 3

Fig. 4

From O. F. Cook, Department of Agriculture

Picture No. 3.—Native Method of Coagulating the Latex or Milk of the Rubber Tree

Fig. 1.—Spreading latex on Calathæa leaf; a leaf already coated shown at the right, lying in the sun to coagulate the rubber. Fig. 2.—Pressing the two coated leaves together to unite the two sheets of rubber. Fig. 3.—Pulling the leaf away from the rubber. Fig. 4.—The finished sample of rubber, marked by the veins of the leaf.



From O. F. Cook, Department of Agriculture

Picture No. 4.—Clusters of Ripe Fruit of the Castilla Rubber Tree

Natural size. The fruit is fleshy and of a reddish orange color

picture No. 2. The ulero makes with his machete diagonal lines of gashes, extending nearly around the tree, like the letter V, the point being downward. The milk flows down these channels to one side of the tree, whence it is led down to a cavity hollowed in the ground and lined with large, tough leaves. These are dexterously lifted up, and the milk is poured out into a calabash or other vessel and carried away to be coagulated. The diagonal channels are from two to three feet apart, and those of each successive tapping are inserted between the older scars. The milk will all run out of the tree in about an hour.

A Castilla tree 5 feet in diameter will yield when first cut about 20 gallons of milk, making 50 pounds of rubber. The tree may be cut again after the lapse of a few months. That the trees at La Zacualpa shown in picture No. 1 have been able to survive so much of this barbarous treatment and are still vigorous and heavily laden with fruit seems to indicate great tenacity of life, and yet even this rough handling represents an improvement upon the former custom of cutting the trees down entirely or hewing steps in them for the ulero to climb up. Instead of the forked stick used as a ladder at La Zacualpa, the large forest trees are ascended for 30 feet or more by means of ropes, vines, climbing irons, and steps cut in the trunk.

The studies which the Department of Agriculture is making in regard to starting rubber plantations on American soil are specially important in view of the disappearance at no distant day of the rubber forests of Brazil and Africa, whence nearly nine-tenths of the supply of rubber now comes. The world is almost entirely dependent on savages, or on natives too barbarous to be called civilized, to get the rubber out of the forests. They, tempted by the high price which rubber brings, swarm into the rubber forests and chop the trees down to save time in collecting the milk.

Mr K. K. Kennedy, U. S. consul at Para, Brazil, has recently sent to the Bureau of Statistics of the Department of Commerce and Labor the startling reports of two expeditions which have been examining conditions in the rubber country.* Captain Gerdeau, after exploring, investigating, and canvassing the territory of the upper Amazon and its tributaries in the richest rubber belt in South America for more than a year, advises him that the rubber gatherers are cutting down the forests with amazing rapidity and improvidence, far beyond what his previous information had led him to expect. He expresses grave doubts if the supply can be kept up unless stringent measures to protect the rubber forests be immediately taken.

Robert Blair Ewart was a member of an American exploring expedition which started inland from Lima, Peru, crossed the Andes, and then descended the tributaries of the Amazon and the great river to Para. Mr Ewart described to Consul Kennedy the rubber-hunting in eastern Peru, along the Ucayali River, a tributary of the Amazon:

"The Ucayali is a magnificent stream, as large as the Mississippi, and traverses one of the finest rubber districts in South America. In all this great territory there is but one man who is producing fine rubber. All the rest are caucho hunters. These latter are the bane of the country, and have done incalculable damage in the past few years. They do not bleed the trees in the regular way, but cut them down and extract the gum by the wholesale. Thus every year enormous forests are destroyed, and each year the supply grows less and less and the rubber gatherers are compelled to go farther back from the rivers. This makes the production of rubber more difficult, dangerous, and expensive each year, and it is only a question of time when this immense and most important rubber-producing terri-

*Daily Consular Reports, October 21, 1903 (No. 1780).

tory will be entirely stripped of its rubber forests. I found that caucho is selling on these far upper rivers for 20 to 22 soles ($10 to $11) per arroba of 32 pounds."

Recently the French government started an industrial school in the Sudan to teach the natives the best methods for rubber gathering. The school has proved a success, as the natives soon realized that the practical suggestions they obtained at the school meant a better quality of rubber and hence greater profit to them.

THE ZIEGLER POLAR EXPEDITION

THE latest news of the Ziegler Polar Expedition is contained in a letter to Mr Ziegler, written by Commander Fiala ten days after leaving Vardö, Norway, and received by Mr Ziegler in New York the later part of September. As far south as 75° north latitude the expedition came upon a compact barrier of ice, which they followed to within sight of Nova Zembla without finding an open lead. At the time of writing they were returning toward the west, intending to try and force a way northward through the ice barrier between the 46th and 47th parallels of east longitude. The ice conditions were thus exceedingly unfavorable at the

Photo by W. S. Champ

Edward Haven, First Officer
W. J. Peters, Representative of the National Geographic Society
Captain Coffin
H. P. Hartt, Chief Engineer
Commander Anthony Fiala, Chief Scientific Staff and Second in Command

Photo by W S. Champ

Some of the Dogs of the Ziegler Polar Expedition

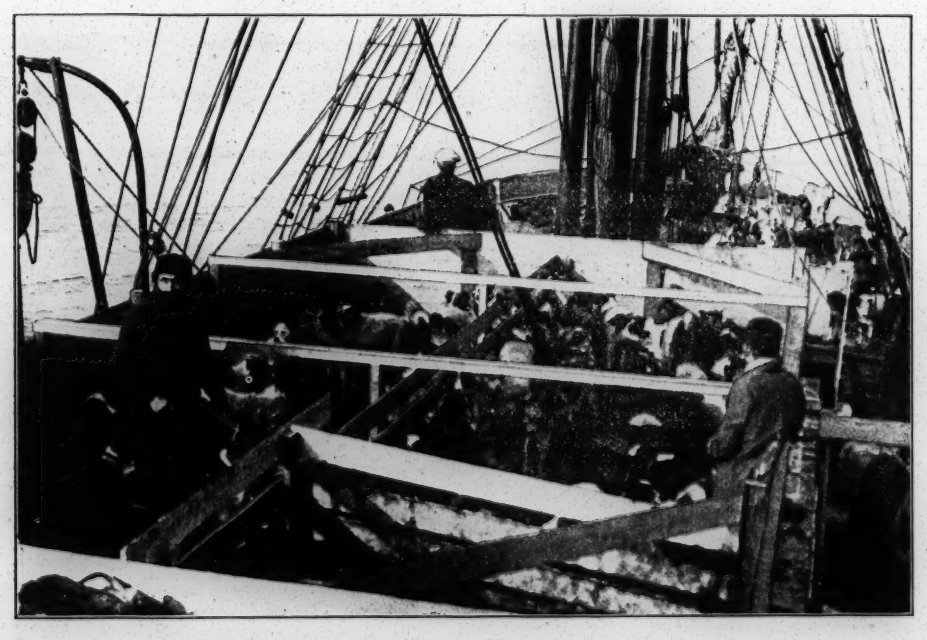


Photo by W. S. Champ

A Deck Scene on the *Amerika*

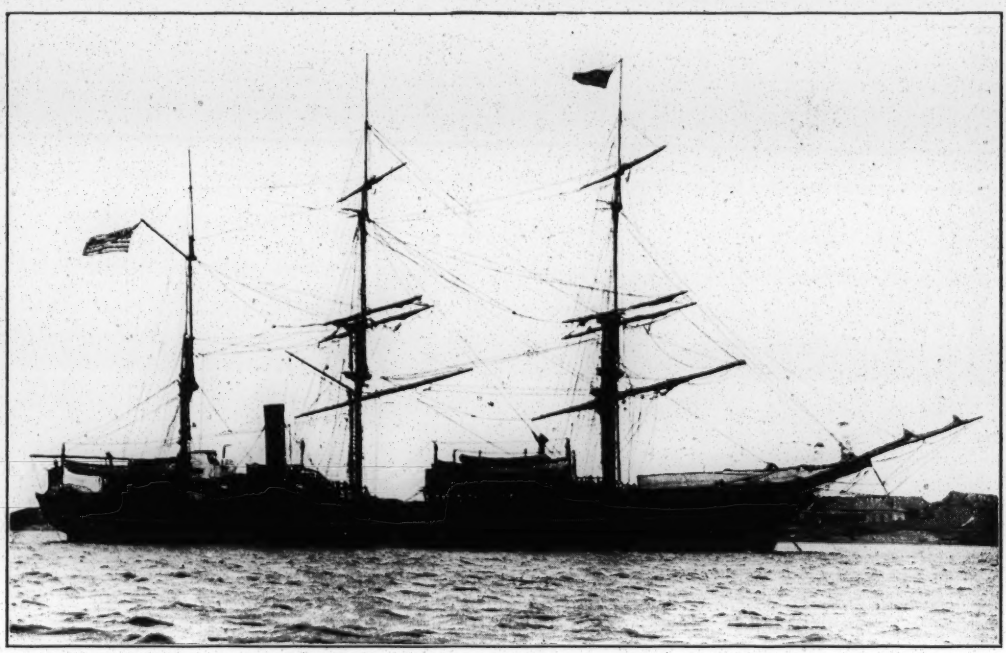


Photo by W. S. Champ

S. S. *Amerika* of the Ziegler Polar Expedition

start, but probably after forcing their way through the barrier they found open water beyond. Mr Fiala's letter is as follows :

BARENTS SEA, *July 20, 1903.*

DEAR MR ZIEGLER :

We are rapidly nearing a sail, and in hopes of this reaching you I write hastily.

We left Archangel on the 4th of July, but as Mr Champ has probably told you, we were delayed by a storm in the White Sea, reaching Vardö, Norway, July 9. At Vardö we took on coal and water, leaving there the evening of the 10th. Since then we have been skirting the edge of the ice pack, vainly looking for a lead. We made a direct course from Vardö, striking the ice at 38° 30′ E. long., 75 N. lat., and then went into the ice to the 75° 38′ ; but it was so solid that we returned and went eastward and southward along the edge of the pack, looking for a lead, until we were near the shores (in plain sight) of Nova Zembla last night in latitude 72° 45′. Not finding a lead of any character worth going into the north ice, we are returning northward and westward, where we intend to push into the ice between the 46th and 47th parallels of E. long., as Captain Coffin thinks it will be the best place to try to *force* our way.

Instead of being a particularly good year as to ice conditions the indications thus far seem to prove otherwise, and the strange silence, from the lack of life, that broods over this waste of ice is peculiar. Dr Shorkley said to me that it seemed to him like a graveyard of ice. We have indeed struck a peculiar season ; numbers of dead birds strewn on the cakes of ice and not one polar bear has been sighted, and only a stray seal once in a great while. It either indi-

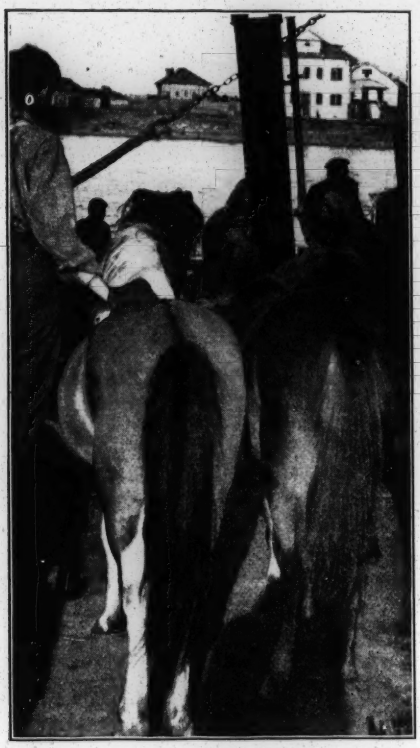


Photo by W. S. Champ

Embarking the Siberian Ponies at Solombala, Siberia

cates immense fields of ice north or lots of open water. Let us hope for the latter.

Everything aboard has been pleasant and harmonious. Men are in splendid condition and happy, though impatient to get north. The horses and dogs are in particularly good form and we are particularly thankful for the coal we took on at Vardö, for we feel we shall need every ounce of it, as we look at the long unbroken mass of ice.

Yours sincerely,

ANTHONY FIALA.

The *Amerika* has been entirely refitted the past year—new decks, new rigging, new boilers, new engines. She makes 8 knots an hour without any help from the wind and rides very easily in spite of her tremendous cargo. The dogs and ponies were taken aboard at Solombala, near Archangel, and seemed in splendid condition.

The expedition left Vardö in excellent spirits and excellent condition. Most important of all, the men and crew had had a chance of working together for several months before the actual start, and it was the unanimous opinion of all that harmony and good-will would continue.

The *Amerika* left Trondhjem June 23, Tromsö June 27, Archangel July 4, and Vardö July 10.

At every port and wherever the expedition or any members of the party went they were received with great courtesy and everything was done by the officials and people to help the work of the expedition. This courteous treatment was much appreciated by all, and acknowledgment of this kindness to them is gratefully made by Mr Ziegler. Special thanks are due to Professor H. Geelmuyden, the distinguished observatorist at the University of Christiania, for loaning the expedition a 20-cen. alt. azimuth circle by Repsold.

THE MINING BUREAU OF THE PHILIPPINE ISLANDS

By Charles H. Burritt,

Chief of the Mining Bureau

THE Mining Bureau of the Philippine Islands was reëstablished on March 10, 1900, by order of Major-General Otis, U. S. Military Governor of the Philippines, and was made successor of the "Inspección General de Minas" of the Spanish Philippine Government and with the same duties. These duties were divided into three divisions, viz:

(*a*.) Supervision and administration of titles and grants.

(*b*.) Supervision and direction over mines, including inspection, sanitation, and police.

(*c*.) Geological and mineralogical surveys and scientific studies.

These duties have nevern bee changed by the American Government, either civil or military, with the exception of subdivision (*a*) above quoted. By the act of Congress of July 1, 1902, the supervision and administration of titles, so far as issuance thereof is concerned, upon all claims for mineral lands instituted after August 14, 1903, was vested in the Insular Bureau of Public Lands. The Spanish titles and grants remain in the Mining Bureau. A thorough examination of these titles and grants has been made, the validity and regularity of each has been determined, and a bulletin has been issued by this Bureau with a classification of all such titles and grants, whether valid or invalid, and with full information as to their inception, location, survey, and other steps of procedure. This is our Bulletin No. 2.

Owing to the insurrection and disturbed conditions, but little could be done under subdivision (*b*). Many mining claims have been instituted and a vast amount of prospecting has been done since the American occupation, and in several provinces a considerable amount of development work has been done. On the Island of Batan the Spanish corporation, "Minas de Carbón de Batan," with a capital of $1,000,000, is now developing the Spanish coal mining grants of Gill Brothers and are proceeding rapidly with a corps of employés, consisting of Spanish and Japanese miners, and with a large force of native employés and laborers. The Villanueva and Muñoz Spanish coal grants on the west of the same Island of Batan have recently been acquired by the United States Government, and by order of the Secretary of War these mines are now being opened up and developed. The work is under the supervision of Lieut. H. L. Wigmore, Corps of Engineers, U. S. A., and I have no doubt of the success of this enterprise. Its importance from an economical and commercial standpoint is not less than its importance as an international factor.

The investigation of the coal measures of the Philippines was the first subject taken up by this Bureau after its reëstablishment, with a view of securing for the United States within its own territorial boundaries in the Orient a supply of steam coal that could be made available in case of an emergency for all governmental purposes and especially for supplying coal to the Philippine and Asiatic Squadrons of the U. S. Navy. Many hundreds of documents were carefully read and studied, and the result presented in the report on "The Coal Measures of the Philippines," by Charles H. Burritt, 1st Lieutenant, 11th U. S. Vol. Cavalry, officer in charge of the Mining Bureau, and published at Wash-

ington in 1901. This report was supplemented by a visit of inspection to the principal known coal deposits by Lieut. Edward M. Markham, Corps of Engineers, U. S. A., under directions of the Secretary of War. As the result of these investigations and reports, the western portion of the Island of Batan was recommended and selected for governmental experiments, and this work is now in progress with every prospect of success.

In 1902 a field party was organized and sent out from this Bureau to make a reconnoissance of the well-known iron region of Angat, Bulacan, and to submit a report thereon as a basis upon which to institute and build up a systematic geological and mineralogical survey of the archipelago and to disseminate such information as to the mineral resources and other conditions as to enable capital to be intelligently directed in the mining industry. Mr Hiram D. McCaskey, B. S., and the mining engineer of this Bureau, a graduate of the Lehigh School of Mines, was placed at the head of this expedition, and his report on "A Geological Reconnoissance of the Iron Region of Angat, Bulacan," a work of 62 pages, with 14 maps, sketches, and tables and 41 half-tone illustrations, has just been issued as "Bulletin No. 3" of this Bureau and from the Bureau of Public Printing of the Government of the Philippines. This work covers a brief description of the class and character of the field work, with subdivision, physical and geographical, geological, lithological, and mineralogical; with a well illustrated description of the iron-mining industry as carried on by the natives and which is one of the oldest mining industries of this archipelago. The Zúñiga theory of the Taal volcano is discussed at length, and the authorities upon that subject are carefully compared. In addition to the iron deposits, the author has also treated of the gold, graphite, and lignite deposits of that region, and has also added a chapter on lime-burning. The tables of analyses of ores are very complete, and the practical questions of labor and transportation are fully presented. The famous mineral springs of Bulacan are also described.

The Bureau has also issued a bulletin (No. 1) on "Platinum and the Associated Rare Metals in Placer Formations" for the use of miners and prospectors.

This completes the publications of the Bureau, but it represents only a small portion of the work that has been done by the Bureau. Questions of titles have constantly arisen, and the manuscript reports on this line make several large volumes. The mining engineer has made a careful study of both the geological and economic conditions so far as the same could be learned from the voluminous records and archives, as well as from prospectors and miners, and scientific expeditions have been made to Culion and Paragua, with preliminary reports thereon. These expeditions, which were only cursory, together with the field work in Bulacan and the study of the archives and records, have enabled this Bureau to frame and recommend to the U. S. Philippine Commission a proposition for the reorganization of this Bureau, transferring all titles to the Bureau of Public Lands, in order that titles on mineral lands may be more economically administered, and placing this Bureau in a condition to take up the work of (*a*) geological and mineralogical surveys and studies and (*b*) the promotion and encouragement of the mining industries, the work in the future to follow along the lines of state geological bureaus or state bureaus of mines in the United States. That there is an urgent demand for this reorganization, and that under it the mining industry will be promoted and in a reasonable time become an important factor in these islands, the writer has no doubt, while the field of geological research is one of untold wealth.

RECORD ASCENTS IN THE HIMALAYAS

DR WILLIAM HUNTER WORKMAN and Mrs Fanny Bullock Workman, members of the National Geographic Society and authors of "In the Ice World of Himalaya," have completed their second consecutive season of high climbing and exploration in the northwest Himalayas, in the region lying between 74° 55′ to 75° 40′ east longitude and 35° 45′ to 36° north latitude. As previously stated,* their attention last year was given to the first exploration of the long Chogo Loongma glacier and its large terminal tributary glaciers, and to ascents of various peaks and passes on these glaciers.

The party consisted this season of Doctor and Mrs Workman, J. Petigax, C. Savoie, and L. Petigax, guides of Courmayeur, and B. Hewett, of London, surveyor. The Hoh Lumba and Sosbon glaciers, running northwest from the Bralches Valley, were first visited. Neither of these had been previously explored, and they were found to be of quite different topography from that indicated on Indian Survey Map, 27*a* N. E. In fact, the Sosbon is sketched on said map only as a small branch of the Hoh Lumba. From the village of Hoh, altitude 9,400 feet, the Hoh Valley was ascended for about 8 miles to Nanghmah Tapsa, a grazing ground at 11,800 feet. From here the ascent was continued over a large old moraine, covered with great blocks and well wooded. This old moraine is followed by one of much newer appearance, covered with smaller rocks and scanty vegetation, and there are evident signs of a rapid retreat of this glacier of late years. Above all this was a large moraine ridge rising to 50 feet above the glacier level. Crossing this the real glacier was attacked at 13,000 feet. Beyond here, it being early summer, the glacier, lateral moraines, and lower mountain spurs were all heavily coated with winter snow and snow camps were everywhere necessary.

One night was passed at 14,400 feet and two at 15,600 feet, at the base of the only depression in the chain of mighty rock needles which encircle the upper end of the Hoh Lumba. This depression, instead of being a long, easy snow pass crossing to a glacier connecting with the Hispar glacier, as marked on the survey map, is an immense overhanging snow cornice surmounting a high, difficult sérac fall. It was ascended in six hours by Dr and Mrs Workman and guides from the highest camp. The height, calculated by hypsometer, later compared with lower-station mercurial barometer readings taken at the same hours, was 18,600 feet. From the great cornice overlooking an abyss of 7,000 feet a medium-sized glacier was observed running in a westerly direction, probably to the Hispar glacier. The length of the Hoh Lumba from its snout to the base of the great col is about nine miles. On the west side of the southern end three small glaciers debouch into the main stream, and on the east a larger feeder enters near the south end. Above this on the east, four miles from the snout of the Hoh glacier, a large glacier of similar importance with the Hoh Lumba comes in, called the Sosbon. Its course is approximately parallel with the Hoh Lumba, and its length from its junction with this is five miles to the col at its source.

Camps were established on this glacier, which was ascended and surveyed, and measurements and angles were taken to determine the rate of movement, and angles also taken to ascertain the heights of various peaks on this and on the Hoh Lumba.

The middle of July the party returned to the chief camp of last year at 14,000 feet on the Chogo Loongma glacier. Here they were imprisoned nearly the whole of the last two weeks of the month

* NAT. GEOG. MAG., Vol. XIII, pp. 405–406.

by severe snowstorms. During a short break in the prolonged storms the only upper branch left unexplored last season was ascended. As the glacier enters the Chogo Loongma at over 16,000 feet and ends at its source, between 18,000 and 19,000 feet, the ascent over new surface snow to the depth of more than 2 feet was most laborious. At a glacier camp at 17,000 feet, one of the highest sun temperatures of the season was taken by a solar radiating thermometer—sun temperature at noon 204° Fahr., shade 56° Fahr.

In August the weather conditions improved and on the 9th, taking advantage of clear, settled weather, Doctor and Mrs Workman and guides, with only high climbing tents and eighteen coolies, left the main camp and ascending Basin glacier, an upper branch of the Chogo Loongma, camped at the base of a high snow peak in the range separating this glacier from the Chogo Loongma. The next day the ascent of its snow slopes was begun and camp brought to 18,400 feet on a small plateau. The third day, in spite of much opposition from coolies, a last camp was pushed to another snow slope at base of the final high cone at 19,355 feet. More than half the coolies were here prostrated by mountain sickness. Late in the afternoon steps were cut by the guides for upward of a thousand feet on the ice slopes, and on the fourth day, leaving camp at 3 a. m. by moonlight, the ascent was begun. The whole of this part of the climb was made in zigzags over slants rising at angles of between 60 and 70 degrees, measured by clinometer, and the summit, 21,770 feet, was reached at 7 a. m.

A narrow ridge connects this peak a few hundred feet below its summit to the north with an elevated snow plateau, from which rise two higher peaks. The party crossed the ridge and ascended the second peak, the summit of which was reached in three hours. The weather was cloudless and the view of the northwest Himalayas unsurpassed. There being little wind, it was possible to take careful boiling point readings which, compared since with a mercurial standard at the lower station of Skardu, fixes the height of this mountain at 22,568 feet.

Mrs Workman has thus broken her former world record for women on Koser Gunge, 21,000 feet, twice on the same day, by 770 and 1,568 feet respectively. While she and one of the guides remained on this summit, Dr Workman and the two others crossed the pleateau and ascended to 23,394 feet on fixed peak 24,486 feet, which gives him the world record for men, the greatest height hitherto attained being the summit of Aconcagua, 22,860 feet, the highest of the Andes. The high camp was again reached at 7 p. m., after an absence of over fifteen hours.

After the 16th of August the whole camp was carried up the Balucho glacier, running east from the Chogo Loongma, where, after two high camps, a new and difficult snow pass of 17,200 feet was ascended by the entire caravan. The difficult descent over a 1,000-foot snow wall was also accomplished after much argument with the coolies, and the expedition found itself on the third day at the junction of a side glacier with the Kero Loongma. This is the first time that a passage over the range separating the Kero and Chogo Loongmas has been effected.

The party next marched to the entrance of the Hucho Alchori glacier, where they were joined by the surveyor. This glacier was explored for the first time, and a snow col 18,200 feet at its source ascended by Mrs Workman and guides.

This season of climbing on new ground adds much valuable material to last year's work. The combined work of the two seasons makes the Workman expedition one of the most important exploring and high-climbing expeditions yet carried out in the northwest Himalayas.

THE NEW CONE OF MONT PELÉE

THE accompanying photographs by Dr E. O. Hovey show the remarkable tooth or spine of solid rock that has pushed up the throat of Mont Pelée since the eruption of May, 1902. The peculiar formation has been previously noted in this Magazine (p. 167, April, 1903). The photographs were taken by Dr Hovey on his recent trip to Martinique and the West Indies in behalf of the American Museum of Natural History. Dr Hovey's report has recently been published in the *American Journal of Science*.

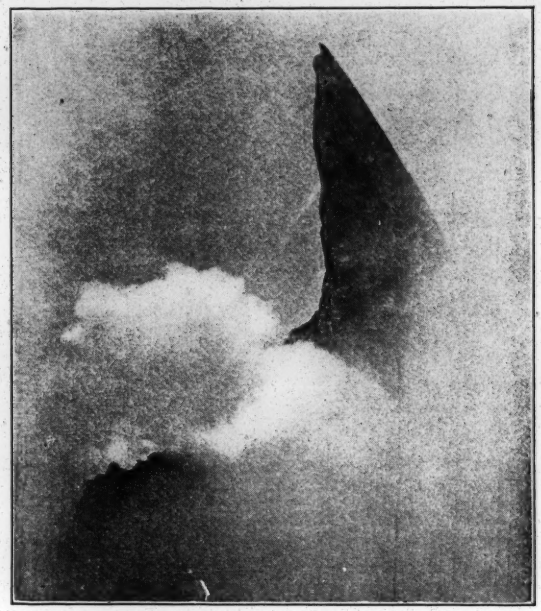
The lofty tooth is rifted and fissured in every direction, and great fragments of it are constantly breaking off. The tooth rests on or is connected with fluid

The New Spine of Mont Pelée from the Basin of the Lac des Palmistes

Looking about S. 60° W. The apex is about 358 meters (1,174 feet) above the rim directly in front. The remains of Morne Lacroix are visible at the right on edge of the crater. Photographed March 25, 1903, for the American Museum of Natural History by Dr E. O. Hovey.

lava beneath. At night the lower portions of it glow with light. Dr Hovey says that in the light of the rising sun the spine looks like an enormous white monument rising above the mountain. Its true color is more a reddish brown with a whitish incrustation over it. No one can say exactly what the nature of the spine is, but the probabilities are that it is largely pumiceous in texture. The masses constantly falling from the sides of the spine, which grows as rapidly as it wears away, will probably in time completely bury the old crater.

The new cone of Mont Pelée, with its great protruding tooth, is not central within the old crater. It has been built up northwest of the center of the old crater. There is no central opening or pit-like depression in the top of the new cone corresponding to the general idea of a crater. Steam issues from all parts of the cone, especially from the top, but none from the tooth.



The Top of the New Spine of Mont Pelée from the Crater Rim

Looking about N. 30° W. Photograph taken March 26, 1903, for the American Museum of Natural History by Dr E. O. Hovey.

Dr Hovey's subsequent studies of the Grande Soufrière of Guadeloupe and the peak of Saba on the same expedition lead him to the conclusion that they have passed through the phases through which Mont Pelée is now passing, and that they all substantiate the cumulo-volcano theory. "This is especially clear in the case of the Grande Soufrière, the cone of which rises above an old crater rim which it has buried in the same way that Mont Pelée is now striving to bury its surrounding crater-walls." *

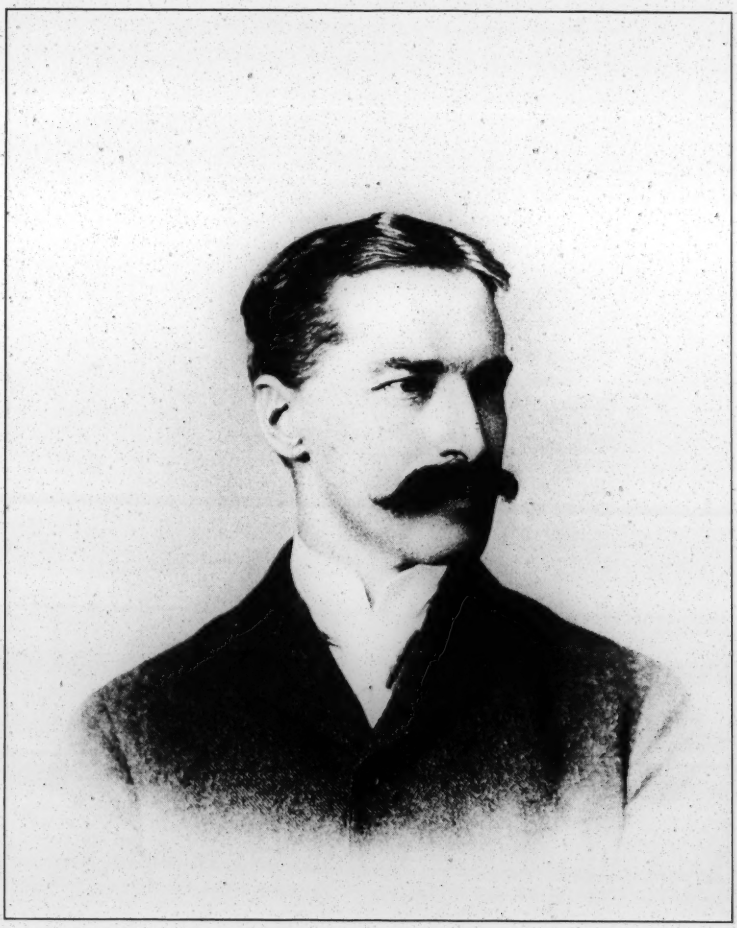
* American Journal of Science, vol. xvi, October, 1903.

Alaskan Boundary Decision. — The award of the Boundary Commission has defined the boundary according to the American claim in practically every respect. This line is shown in a map published in the NATIONAL GEOGRAPHIC MAGAZINE on page 90, March, 1903. The award makes one change in this map, in Portland Canal. Portland Canal has two parallel channels, with four islands between them. Canada claimed that the northern channel and the United States that the southern channel was Portland Canal and the boundary. By the decision Portland Canal—*i. e.*, the boundary—passes north of Pearse and Wales Islands (which are the innermost islands of the four) and enters the ocean through Tongass Passage, between Wales and Sitklan Islands. Canada thus acquires Pearse and Wales Islands, and the United States Sitklan and Kantgunut Islands, the two outermost of the four islands.

RICHARD URQUHART GOODE

MR RICHARD URQUHART GOODE, Geographer of the U. S. Geological Survey and one of the most interested members of the National Geographic Society since the organization of the Society in 1888, died from pneumonia at Rockville, Md., June 9, 1903. His death was entirely unexpected and came as a great shock after an illness of only three days.

Mr Goode was born at Bedford, Virginia, in 1858. After a course at the University of Virginia, he joined the Engineer Corps of the Army in 1878. In 1879 he became a topographer of the U. S. Geological Survey, and from 1882 to 1884 was attached to the Northern Transcontinental Survey as engineer and topographer. In 1889 he was appointed to the rank of geographer in the Geological Survey, and has had special charge of the surveys in the Pacific Coast States—California, Oregon, and Washington.



Richard Urquhart Goode

He was a member of the Washington Academy of Sciences and the author of several bulletins published by the Geological Survey.

During 1901–1903 Mr Goode was the chairman of the Committee on Technical Meetings of the National Geographic Society. He has been an occasional contributor to the NATIONAL GEOGRAPHIC MAGAZINE, his last article being published in January, 1900, "The Idaho-Montana Boundary Line."

Mr Goode was a man of exceedingly attractive personality, whose sudden death in the prime of life is mourned by a large circle of warm friends.

NATIONAL GEOGRAPHIC SOCIETY

PROFESSOR A. J. HENRY, Secretary of the National Geographic Society since November, 1899, because of the pressure of responsible official duties and ill-health, was obliged to resign from the secretaryship October 2, 1903. The prosperity and continued activity of the National Geographic Society during the last four years have been largely due to the personal attention and zeal which Professor Henry has freely and constantly given to the Society. His resignation has been accepted by the Board of Managers with exceeding regret.

The new Secretary of the Society is Hon. O. P. Austin, who was unanimously elected by the Board of Managers. Mr Austin is Chief of the Bureau of Statistics of the Department of Commerce and Labor, and has been a member of the Board of Managers of the Society since January, 1903. By means of the original monthly monographs and other contributions of the Bureau of Statistics, as well as by his personal publications, he may be said to have originated a new school of commercial geography in the United States.

The expedition of Dr Frederick Cook for the ascent of Mount McKinley, and also the expedition of Miss Annie S. Peck for the ascent of Mount Sorata, were unsuccessful in gaining the summits of these lofty mountains.

A new division has been established in the U. S. Geological Survey, entitled the "Division of Alaskan Mineral Resources," which will embrace all of the investigations and surveys being carried on in Alaska. This division is coördinate with the others of the geologic branch of the Survey, and its chief will report to the director. Mr Alfred H. Brooks has been made chief of the new division.

GEOGRAPHIC LITERATURE

Elements of Geology. By Joseph Le Conte. Revised and partly rewritten by Herman Le Roy Fairchild. Fifth edition. With over 1,000 figures in the text. Pp. xii + 767. 6 x 9 inches. New York: D. Appleton & Co. 1903. $4.00.

This fifth edition of a work which for 25 years has been the standard textbook of geology is most welcome. Prof. H. L. Fairchild, who has edited this latest edition and partly rewritten the volume, is the head of the department of geology at the University of Rochester and formerly Secretary of the Geological Society of America. He is eminently qualified to bring the work down to date and to incorporate the latest theories and conclusions, giving proportionate weight to each new hypothesis advanced since the last edition of the work. One of the most important of these is the theory of Prof. T. C. Chamberlin concerning the origin of the earth.

He opposes the nebular theory of the earth's origin and asserts instead the "planetesimal" hypothesis. According to this theory, "the earth, and the moon as well, have grown by slow accretion, or infall, of small, cold, discrete particles (planetesimals), which formed the earth-moon ring or zone. The ocean and the atmosphere have slowly accumulated from the gases originally held in the planetesimals, being forced to the earth's surface by interior consolidation due to gravity. The heat of the earth's interior is, under this theory, due to gravitational compression similar to the production of the sun's heat." The oceanic stage was reached long before the earth attained its present size. To summarize, the Chamberlin school believe that the outside of the earth has always been cold, and that the heat inside is due to gravitational compressions. The nebular theory is that the globe was once a fiery mass. The outside has cooled, but the inside is still as hot as it was eons ago. The planetesimal theory is unsettling some long-accepted theories of geology.

Geography of Commerce. By Spencer Trotter. With many maps and illustrations. Pp. xxiv + 410 5½ x 8 inches. New York: The Macmillan Co., 1903. $1.10 net.

As the author very correctly remarks in the preface of this volume, "The unrelated facts of commerce have slight educational value; they should be made to illustrate some underlying principle, to make clear a natural law, to stand in relation to the great stream of causes and effects." Dr Trotter has kept this principle in mind while writing his commercial geography; when he describes the great business centers or the principal producing areas of the country, he invariably explains what causes, physical, political, etc., make them prominent. The result is he has produced a book that not only describes the special industries and occupations of the various sections of the United States and of the world, but also imparts a great many facts about the physical and political geography of the countries. The illustrations, diagrams, and references are admirably chosen. The one serious criticism that might be made of the volume is that the author has tried to include too much information; his chapters sometimes resemble condensed cyclopædic articles; the style is also heavy, so that while the book will be a useful help to the teacher it may prove rather dull for the pupil.

The Philippine Islands, 1493–1803. Explorations by early navigators, descriptions of the islands and their peoples, their history, and records of the Catholic missions, as related in contemporaneous books and manuscripts, showing the political, economic, commercial, and religious conditions of those islands from their earliest relations with European nations to the beginning of the nineteenth century. Translated from the originals (Spanish, French, Italian, Latin, etc.), many of which are now published for the first time. Edited and annotated by Emma Helen Blair, A. M., of the State Historical Society of Wisconsin, assistant editor of *The Jesuit Relations and Allied Documents*, and James Alexander Robertson, Ph. B., with historical introduction and notes by Edward Gaylord Bourne, Professor of History in Yale University; also a full bibliography and analytical index. With maps, portraits, and other illustrations. Fifty-five volumes, large 8vo, about 325 pages per volume. Cleveland, Ohio: The Arthur H. Clark Company. 1903. $4.00 *net* per volume.

The purpose of this magnificent series of volumes is to place within reach of the American public the most important of the hundreds of manuscripts, letters, and documents relating to the Philippine Islands and written between 1493 and

1803. The writers were mainly soldiers, government officials, and ecclesiastics of the various orders. Some of the letters are personal and others administrative reports and recommendations. Five volumes have been published, and others will follow monthly. These five alone contain much information about the early conditions on the islands that cannot be obtained elsewhere.

The Spaniards in the Philippines from the very first conceived a great contempt for the Chinese across the China Sea. One general offered, with less than 60 good Spanish soldiers, to march from Canton to Peking and subdue the whole empire, though there were "many very populous cities on the way" and the king was "well prepared for war and the frontiers are well fortified with many forts with artillery and garrisons wherein strict watch is kept." Other generals repeatedly urged the conquest of the Chinese Empire, and every one guaranteed to do it with less than 2,000 or 3,000 men. This was during the last half of the sixteenth century when Spain was too much occupied with her European designs to spare the men or money to enter China.

The Training of Wild Animals. By Frank C. Bostock, edited by Ellen Velvin. Illustrated. Pp. xvii + 256. 5x7 inches. New York: The Century Co., 1903.

A book on this subject by the celebrated trainer, Frank C. Bostock, is not only interesting, but gives much insight about the characters of the larger animals. Temperaments and dispositions differ as much among lions or tigers or other animals as among men. Cruelty is useless as well as dangerous in training the great beasts. Intelligence, pluck, vigilance, and patience are the requisites of a trainer.

"There are three essentials in the care and feeding of wild animals—good food, cleanliness, and exercise. Food and cleanliness come first, but exercise is nearly as important, and this is one of the main reasons why animals in traveling shows are so much healthier and stronger than those kept in zoölogical parks. In the parks they get food and cleanliness, but little exercise; for wild animals are proverbially lazy, and, unless compelled by hunger or force of circumstances, will not exert themselves in the least, preferring to lie about and sleep rather than even to walk round their cages."

In a chapter on "How Wild Animals are Captured," Mr Bostock tells how the natives in India catch tigers:

"The leaves of the sycamore and large plantain are smeared with a sticky substance and left in the trail of the tiger. The moment the animal puts his foot on one of these leaves he immediately rubs it over his head in order to get rid of it. This naturally makes his head sticky and uncomfortable, which causes him to roll on the ground. By doing this he becomes covered with the leaves, and when he is mad with rage the natives come cautiously up and cover him with strong nets and sacking."

Texas. By George P. Garrison. With map. Pp. v+320. 5x7 inches. Boston: Houghton, Mifflin & Co. 1903. $1.10 *net.*

The book is a disappointment, or perhaps it would be more just to say the title is a misnomer. The romantic history of the great territory is well told, but the author stops there. A single chapter of 12 pages is all he has to say of the tremendous development of the state since 1876. A few paragraphs only are devoted to describing what Texas is today. There is hardly a word about her unrivaled natural resources, which are going to make her the greatest producer among the states. The reader wants to know not only how the Texan won his freedom, but how he developed the state after it was won and what the state is now.

PROGRAM OF MEETINGS OF NATIONAL GEOGRAPHIC SOCIETY, 1903-1904

THE National Geographic Society has recently moved into its new home, the Gardiner Greene Hubbard Memorial Hall, Sixteenth and M streets. As the building is not entirely completed, the formal opening of the hall will be deferred for the present.

The National Geographic Society presents during the season of 1903-1904 three courses of meetings—a Popular Series of 10 illustrated lectures, a Scientific Series of 10 meetings, and an Afternoon Series of 5 popular lectures.

The Society aims to present in the Popular Course subjects of a geographic character that possess an immediate interest for the public.

The Scientific Meetings are planned particularly for men actively engaged in geographic work. While these meetings are designed for scientific workers, they have proved during the last two winters of great interest to a large number of others, who do not profess to be geographers, but who wish to follow what is being done by the scientific departments of the government and by specialists throughout the United States.

POPULAR COURSE

The lectures in the Popular Course will be delivered in the National Rifles Armory, 920 G street, at 8 p. m., on the following dates:

Saturday, October 24.—"Arctic Exploration." By Commander Robert E. Peary, U. S. N. Illustrated.

Friday, November 13.—"On the action of Radium, Roentgen Rays, and Ultra Violet Light upon minerals, with radium of 300,000 and 1,800,000 activity." By Mr George F. Kunz and Dr Charles Baskerville.

Friday, November 27.—"Taking the Census of the Filipinos." By Mr Henry Gannett, of the U. S. Geological Survey Illustrated.

Saturday, December 12.—"Marches and Movements of Arnold and André." By Mr W. W. Ellsworth, of the Century Co. Illustrated.

Announcement of definite dates for the following lectures in this course will be made later:

"Joys of the Trail," by Mr Hamlin Garland, author of "The Captain of the Gray Horse Troop," etc. Illustrated.

"Conditions in Macedonia," by Dr Edwin A. Grosvenor, of Amherst College. Illustrated.

"The Louisiana Purchase Exposition," by Hon. David R. Francis, President of the Louisiana Purchase Exposition. Illustrated.

"Travels in Arabia and Along the Persian Gulf," by David G. Fairchild, Special Agent of the U. S. Department of Agriculture. Illustrated.

Provisional arrangements have also been made for addresses on—

Little Known Peoples of Mexico.

Russia and Japan in Korea.

The Alaskan Boundary Decision.

SCIENTIFIC COURSE

The first three meetings of this course will be held in the Assembly Hall of the Cosmos Club, Fifteenth and H streets. The succeeding meetings will be at the new home of the Society, Hubbard Memorial Hall.

November 20.—"European Methods of Checking Advancing Sand Dunes." A. S. Hitchcock, Assistant Agrostologist, Department of Agriculture.

December 4.—"The Work of the Bureau of Plant Industry." Dr B. T. Galloway.

December 18.—"Early Spanish Cartography of the New World," by Prof. E. L. Stevenson, of Rutgers College.

At later meetings the geographical work of the Bureau of Insular Affairs, of the U. S. Fish Commission, of the National Bureau of Standards, of the Biological Survey, of the Bureau of Immigration, and of the Bureau of Statistics of the Department of Commerce and Labor will be discussed.

AFTERNOON COURSE

The general subject of the Afternoon Course of popular lectures is "The Growth of Diplomacy." The special topics and the names of the speakers will be announced in a later program. The first of the series will be given on Tuesday, February 23, and the succeeding lectures on March 1, 8, 15, and 22.

These lectures will be illustrated.

LECTURE TICKETS

Each member of the Society can purchase one season ticket, admitting two persons to all lectures, for three dollars.

Persons not members of the Society may purchase one ticket, admitting two persons to all lectures, for six dollars.

Single admission tickets, at fifty cents each, may be obtained at Hubbard Memorial Hall or at the lecture-hall door.

APPLICATIONS FOR MEMBERSHIP

Applications for membership in the Society should be sent to the Secretary, who will present all nominations to the Board of Managers for action by them. The dues for members are two dollars per annum. All members receive the NATIONAL GEOGRAPHIC MAGAZINE, an illustrated monthly, issued by the Society. Annual dues may be commuted and life membership acquired by the payment of fifty dollars. The membership fee of two dollars, for persons elected to the Society in November and December, includes all dues to January 1, 1905.

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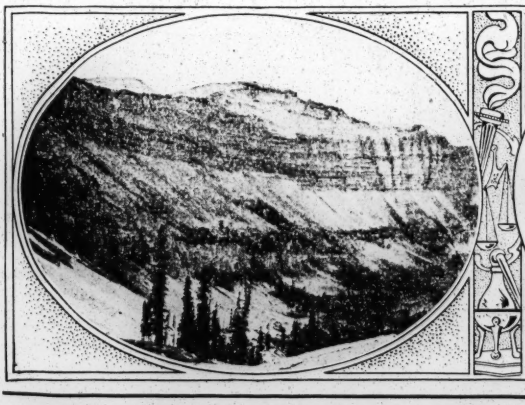

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